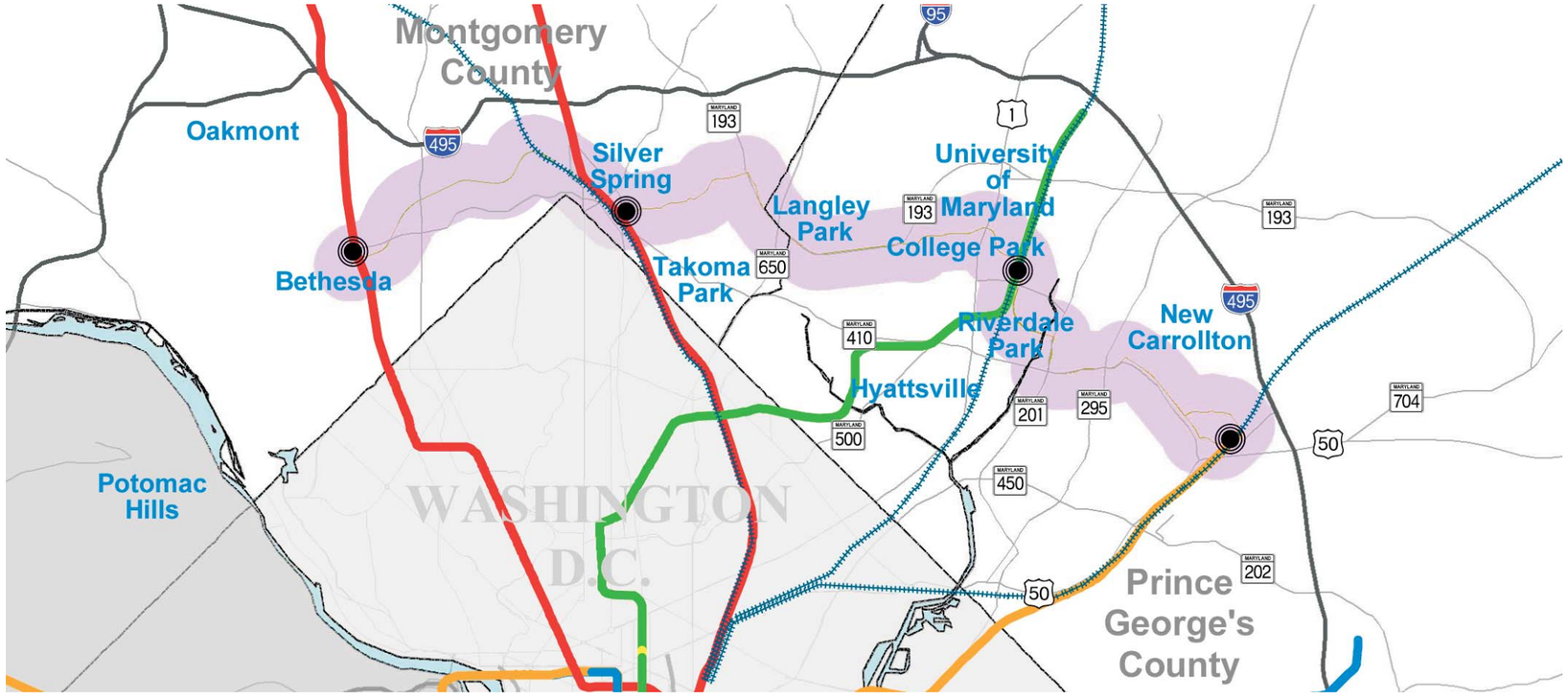
Purple Line

Alternatives Analysis

Draft Environmental Impact Statement



U.S. Department of Transportation
Federal Transit Administration

Maryland Department of Transportation

MTA Maryland Transit Administration

September 2008

Purple Line
Montgomery and Prince George's Counties, Maryland

Alternatives Analysis/Draft Environmental Impact Statement and Section 4(f) Evaluation

Prepared in accordance with the National Environmental Policy Act of 1969, §102 (42 U.S.C. §4332); and Federal Transit Laws (49 U.S.C. §5301(e), §5323(b), and §5324(b)); and 49 U.S.C. §303 (formerly Department of Transportation Act of 1966, §4(f)); National Historic Preservation Act of 1966, §106 (16 U.S.C. §470f); Executive Order 11990 (Protection of Wetlands); Executive Order 11988 (Floodplain Management); and Executive Order 12898 (Environmental Justice).

by the **Federal Transit Administration**
US Department of Transportation

Letitia A. Thompson
Regional Administrator, Region III
Federal Transit Administration

9/30/08
Date of Approval

and the **Maryland Transit Administration**
Maryland Department of Transportation

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10/1/08
Date of Approval

Abstract

The Purple Line is a proposed 16-mile rapid transit line extending from Bethesda in Montgomery County to New Carrollton in Prince George's County. The purpose of the project is to address mobility and accessibility issues in the corridor. The Purple Line would connect the major activity centers in the corridor and will provide direct rapid transit connections to the Metrorail Red Line (Bethesda and Silver Spring Metro Stations), Green Line (College Park Metro Station) and Orange Line (New Carrollton Metro Station). The Purple Line will also connect to MARC, Amtrak, and local bus services.

The alternatives include: the No Build Alternative, the Transportation Systems Management (TSM) Alternative, and six Build Alternatives. The Build Alternatives include three using bus rapid transit (BRT) technology and three using light rail transit (LRT) technology. The project would be completed in a manner that minimizes adverse effects on the environment and maximizes benefits to the communities.

This document describes and summarizes the potential transportation and environmental effects, costs and benefits, and presents a comparative evaluation of the alternatives.

For further information concerning this document, contact:

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Comments on Purple Line Alternatives Analysis/Draft Environmental Impact Statement and Section 4(f) Evaluation

Comments on this document may be submitted in writing. Written comments are due 90 days following the Notice of Availability. Written comments can be sent to Diane Ratcliff at the address listed on Page 1; through the project website at www.purplelinemd.com; emailed to purpleline@mtamaryland.com; or submitted at the public hearings. Comments may be made orally at the public hearings. Please include your contact information with your comments.

Information on the date, time, and location of the public hearings will be published in local and regional newspapers and on the project website.

For questions regarding the Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) or general project information, please contact Michael Madden, at the following address:

Michael Madden

Project Manager
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Maryland Transit Administration
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Baltimore, MD 21202
410-767-3694

Document Availability

The AA/DEIS and related Technical Reports are available on the project website at www.purplelinemd.com. Copies of the documents are available on a CD from MTA through the project website or using the contact address. Printed copies of the AA/DEIS are available for public review at the following locations:

Bethesda Library

Bladensburg Library

Chevy Chase Library

Greenbelt Library

Hyattsville Library

Long Branch Library

Maryland Department of Legislative Services Library

Maryland State Archives

Maryland State Law Library

New Carrollton Library

Silver Spring Library

State Library Resource Center

Takoma Park Maryland Library

University of Maryland Library

M-NCPPC - Montgomery County

M-NCPPC - Prince George's County

Silver Spring Regional Services Center

Maryland Department of Transportation - New Carrollton Regional Office

Technical Reports

- Air Quality Technical Report
- Architectural History Technical Report
- Capital Cost Estimating Methodology Technical Report
- Conceptual Plans
- Definition of Alternatives Report
- Energy Technical Report
- Geotechnical Data Technical Report
- Hazardous Materials Technical Report: Initial Site Assessment
- Natural Resources Technical Report
- Noise and Vibration Technical Report
- Operating and Maintenance Cost Estimate Technical Report
- Phase Ia Archeological Assessment Survey Technical Report
- Preliminary Section 4(f) Evaluation Technical Report
- Public Outreach and Coordination Technical Report
- Socioeconomic Technical Report
- Traffic Analysis Technical Report
- Travel Demand Forecasting Technical Report

The Technical Reports are available for public review (upon request) at the MTA offices located at 6 St. Paul Street, 9th Floor, Baltimore, MD 21202 or via the project website at www.purplelinemd.com. Any person with special needs, such as English language assistance or Braille should contact the MTA for assistance.

Printed copies of the Technical Reports can also be viewed at:

M-NCPPC - Montgomery County

M-NCPPC - Prince George's County

Silver Spring Regional Services Center

Maryland Department of Transportation - New Carrollton Regional Office

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Preface

Planning Context

Planning and Project Development Process

This Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) conducted by the Maryland Transit Administration (MTA) was developed to support local decision-making on the need for transit investments in the Purple Line corridor, as well as the type and scale of those investments.

This study was conducted to meet the requirements of the National Environmental Policy Act of 1969 (NEPA). This act requires consideration of the impacts to the natural and human environment of any federal action. NEPA requires a systematic interdisciplinary approach and requires certain statements, including the following:

- The environmental impacts of the action
- Adverse impacts that cannot be avoided
- Alternatives to the proposed action
- Consequences of the proposed action

In addition, consultation with federal agencies and public participation in the planning process are required.

This document is also an Alternatives Analysis, prepared for the Federal Transit Administration (FTA) in accordance with Congressional mandates. The requirements of the AA process are intended to allow for an objective, efficient, and fully informed evaluation and rating of the transit projects seeking funding under the Federal New Starts process. The FTA discretionary New Starts program is the federal government's primary financial resource for funding locally planned, implemented, and operated transit "guideway" capital investments.

Washington Metropolitan Area Transportation Plan

Construction of the Washington Metropolitan Area Transit Authority Metrorail system began in 1967. The final leg of the original 103-mile rail network was completed in early 2001. Today, there are 86 Metro stations and five lines in the 106-mile network.

The Metro was designed to serve passengers traveling between Washington, DC and the suburbs. As travel patterns have changed, a result of an increase in jobs in the suburbs, suburb-to-suburb travel is increasing. The Purple Line would provide an east-west travel service and provide access to the radial Metro system. There are no other programmed high capacity transit projects that would provide such service in the Maryland portion of the Washington metropolitan area.

Prior Studies of the Corridor

This project arose out of several previous studies; most directly, the *Georgetown Branch Transitway/Trail Major Investment Study/Draft Environmental Impact Statement* in 1996 and the *Capital Beltway/Purple Line Corridor Transportation Study* completed in 2002. The former was a study to consider transit alternatives between Bethesda and Silver Spring on the Georgetown Branch right-of-way, an abandoned rail corridor purchased by Montgomery County for transportation uses in 1988. The latter was a joint study by the Maryland State Highway Administration and the MTA that identified the corridor as a priority for transit in the context of addressing congestion on the heavily used Capital Beltway corridor. An overview of the planning history of the Purple Line is presented in Chapter 1.

Purpose of the AA/DEIS

Decision At Hand

The MTA has undertaken this AA/DEIS to study a range of means for addressing mobility and accessibility issues in the corridor between Bethesda and New Carrollton in Montgomery and Prince George's Counties, Maryland, just north of the District of Columbia boundary. The study is considering a range of alternatives to improve east-west transit mobility in the 16-mile corridor that connects several major activity centers at the Metrorail stations, Bethesda, Silver Spring (both on the Red Line), College Park (Green Line), and New Carrollton (Orange Line) as well as the Takoma Park/ Langley Park area and the University of Maryland.

Changing land uses in the Washington metropolitan area have resulted in more suburb-to-suburb travel, while the existing transit system is oriented toward radial travel in and out of Washington, DC. The only transit service available for east-west travel is bus service, which is slow and unreliable because it operates on congested roadways between major activity centers in the corridor. There is no efficient, reliable, and high capacity transit for east-west travel in the corridor. The Purple Line would serve transit patrons whose journey is solely east-west in the corridor, as well as those who want to access the existing north-south Metrorail system. The Purple Line would also provide a direct link to the Brunswick, Camden, and Penn Lines of the MARC commuter rail system and to Amtrak's Northeast Corridor service at New Carrollton.

The Purple Line is intended to provide enhanced transportation choices and improved access for people in the corridor; support local plans for economic development, community revitalization, and transit oriented development in the area; improve system efficiency and intermodal connectivity; and help address the region's air quality issues.

This study examines several different alternatives, from modest investments in shared-use roadways, to major investments in a dedicated guideway, grade-separated where necessary, to determine which alternative achieves the greatest mobility and related benefits, balanced against costs and impacts on communities and the environment. Two modes, bus transit rapid (BRT) and light rail transit (LRT), were identified during the public scoping process as the most appropriate for this project.

How the AA/DEIS Supports Decision Making

The objective of this planning process is to provide the public and decision-makers with appropriate and relevant information to make an informed decision on which alternative to select. This process is intended to provide all interested parties with the opportunity to contribute to the planning process and be informed about pertinent issues.

The public and agency scoping process for the Purple Line was initiated in September 2003. The goal of the scoping process and the continued public, agency, and stakeholder involvement process was to ensure that all reasonable and cost-effective alternatives that met the purpose and need of the project were studied.

The evaluation of the alternatives was an iterative process that included extensive coordination with public agencies, elected officials, stakeholders, and members of the public. Alternatives were evaluated for

environmental impacts, engineering constraints, transportation benefits, economic development opportunities, costs, and cost-effectiveness.

The final stage of the AA/DEIS process is the circulation of this document to the public and agencies. The document will be available for review at public locations, and online for 90 days at www.purplelinemd.com. Public hearings will be held to record public and agency comments on the proposed project. These comments will be included in the project records and will be responded to in the Final Environmental Impact Statement (FEIS).

Selection of the LPA

After consideration of comments received the State of Maryland will select a Locally Preferred Alternative in consultation with county and local jurisdiction officials and elected officials. The selection will be based on consideration of, and trade off among benefits, costs, environmental impacts, and affordability of the alternatives. The Locally Preferred Alternative could include project implementation phasing that involves an initial implementation phase, referred to as a minimum operable segment, and a plan and schedule for subsequent implementation phases.

Next Steps

Once the Locally Preferred Alternative is selected, the MTA will prepare a New Starts Criteria Package and a Request for Permission to Enter Preliminary Engineering. This is part of the FTA New Starts process required for eligibility for federal funding under the *Final Rule for Major Capital Investment Projects* (2000). Once permission is granted, the MTA will begin the preliminary engineering needed for preparation of the FEIS. This process will include preliminary engineering on the selected alternative to approximately 30 percent of design completion, the definition of the right-of-way requirements and environmental mitigation, and assessment of design options. Upon completion of the FEIS, the project would request a Record of Decision from the FTA.

Organization of this AA/DEIS

The **Signature Page** presents the signatures of the officials approving the findings contained in the AA/DEIS document, as recommended by the Council on Environmental Quality.

Also included are:

- The project description
- Lead agencies
- A list of locations where the AA/DEIS is available for public review
- Information on upcoming AA/DEIS Public Hearings and the public comment period
- Contact addresses for questions, comments, and requests for information on the Purple Line

The **Table of Contents** presents the overall organization of the AA/DEIS and directs the reader to the appropriate page numbers for various chapters and sections in the document.

The **Preface** summarizes the organization and the purpose of the AA/DEIS.

The **Executive Summary** briefly presents the major components and findings of the study.

Chapter 1 – Purpose and Need describes the purpose and need for transit improvements in the Purple Line corridor, and highlights the major transportation issues and related project goals and objectives.

Chapter 2 – Alternatives Considered summarizes the alternatives initially developed and those alternatives later eliminated from further consideration (and the reasons why), and describes the No Build Alternative, the TSM Alternative, and the six Build Alternatives that have been assessed in detail in the AA/DEIS.

Chapter 3 – Transportation and Traffic describes the potential long-term impacts of the alternatives relative to public transportation, rail stations and parking, roadways, bicycle and pedestrian facilities.

Chapter 4 – Environmental Resources, Impacts, and Mitigation describes the potential long-term impacts of the alternatives on key resources of the natural and human environment.

Each section of Chapter 3 and Chapter 4 describes existing conditions, forecasts those conditions to 2030, both with and without the alternatives, and identifies the beneficial and adverse effects (if any) of the alternatives, and where appropriate, identifies possible mitigation measures.

Chapter 5 – Costs and Funding compares the capital, operating and maintenance costs for the TSM and Build Alternatives, presents potential strategies for financing those costs, and identifies potential funding shortfalls and implementation strategies.

Chapter 6 – Evaluation of Alternatives presents the results of the analyses described in the previous chapters. The relative merits and adverse impacts of the eight alternatives are compared. Chapter 6 uses the information presented in Chapters 3, 4, and 5 to discuss how well the alternatives would address the project purpose, needs, and goals. This chapter also describes key measures and how they could affect decision-making concerning the choice of a selected alternative.

Appended to this AA/DEIS are the following:

- **Glossary and Acronyms**
- **List of Recipients**
- **References**
- **List of Preparers**

AA/DEIS Document

Attached to the printed version of the AA/DEIS is a CD containing the AA/DEIS and the supporting Technical Reports, including methods and assumptions that provided the basis for the technical analyses and findings summarized in the AA/DEIS.

Printed copies of the AA/DEIS and supporting technical documentation are available for public review at selected locations (see List of Recipients) and (upon request) at the MTA offices located at 6 St. Paul Street, 9th Floor, Baltimore, Maryland 21202 or via the project website at www.purplelinemd.com. Any person with special needs, such as English language assistance or Braille, should contact the MTA for assistance.

Executive Summary

Executive Summary

The Purple Line is a 16-mile rapid transitway extending from Bethesda in Montgomery County to New Carrollton in Prince George's County, proposed by the Maryland Transit Administration (MTA). It would provide direct connections to the Metrorail Red, Green, and Orange Lines; at Bethesda, Silver Spring, College Park, and New Carrollton. The Purple Line would also connect to MARC, Amtrak, and local bus services. In addition to providing connections to other transit services, the Purple Line would connect the major activity centers in the corridor. The alternatives under consideration include the No Build Alternative, the Transportation Systems Management (TSM) alternative, and six Build alternatives. The Build alternatives include three using bus rapid transit (BRT) technology and three using light rail transit (LRT) technology. The project would be designed and constructed in a manner that minimizes adverse effects on the environment and maximizes benefits to the communities.

This Executive Summary presents the major elements and findings of the study and includes a brief comparison of potential environmental effects of each alternative under consideration. A discussion of the next steps in the planning process for the Purple Line is also included.

Purpose of this Alternatives Analysis/ Draft Environmental Impact Statement

The Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) compares the potential transportation and environmental impacts, costs, and benefits of the No Build, TSM, and Build alternatives under consideration.

The AA/DEIS summarizes the detailed technical data contained in the Technical Reports, incorporates that information by reference, and provides the information necessary to make an informed decision. A CD containing the AA/DEIS and the supporting Technical Reports, including methodologies and assumptions that provided the basis for the technical analyses and findings summarized in the AA/DEIS is attached to the printed version of the AA/DEIS document as well as to the stand alone version of the Executive Summary.

Both the AA/DEIS and the technical documentation are available on the project website, www.purplelinemd.com.

Printed copies of the AA/DEIS and supporting technical documentation are available for public review at selected public libraries, Maryland-National Capital Park and Planning Commission offices in Montgomery and Prince George's County, Silver Spring Regional Services Center, and Maryland Department of Transportation Regional Office in New Carrollton, and (upon request) at the MTA offices located at 6 St. Paul Street, 9th Floor, Baltimore, Maryland 21202. Any person with special needs, such as English language assistance or Braille, should contact the MTA for assistance.

Purpose and Need for the Purple Line

The purpose of the Purple Line is to address mobility and accessibility issues in the corridor between Bethesda and New Carrollton.

The project proposes to increase transportation choices for people living and working in the region; improve the quality of the existing transportation system; support local plans for economic development, community revitalization, and transit oriented development; improve system efficiency and intermodal connectivity; and help the region address air quality issues.

Improvements to the transportation system in the corridor would help address the following transportation challenges:

- Increasing congestion on the roadway system
- Slow and unreliable transit travel times due to the congested roadway system
- Limited travel mode options for east-west travel
- Degraded mobility and accessibility between activity centers, employment hubs, and residential areas
- Degraded transit accessibility to the larger metropolitan region due to inferior connections to radial Metrorail lines and to other rail and bus services

The Purple Line would increase mobility and improve access to jobs, recreation, and shopping for those traveling to, from, or within the corridor. The Purple Line will improve transit efficiencies linking multiple north-south routes with a convenient east-west connection and direct links to major activity centers.

A number of areas in the corridor are pursuing economic and community revitalization. Some of these areas are already the focus of economic incentive programs by local governments, and a substantial improvement in the quality of transit services has been identified by local planning agencies as a key factor in the success of these efforts.

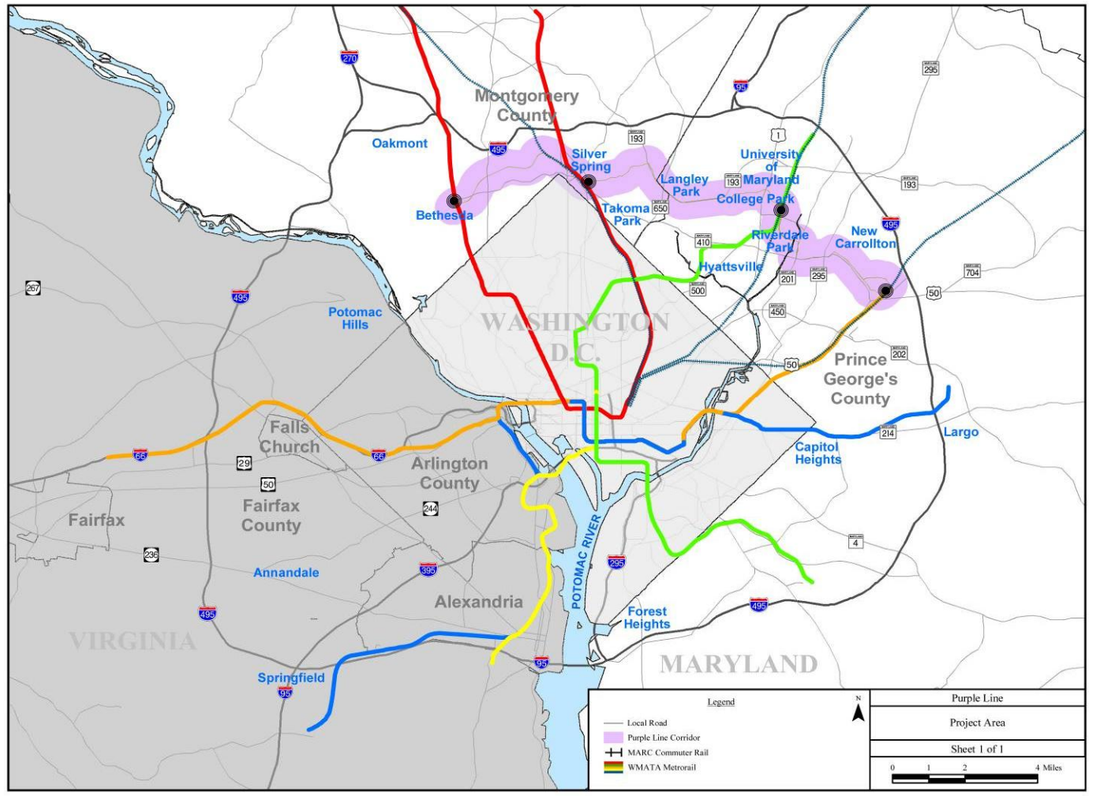
Poor air quality affects the health of residents as well as the availability of federal funding assistance for transportation investments throughout the region. Almost half of the emissions that cause ozone in the region come from cars, trucks, and buses; and motor vehicle emission burdens are projected to increase substantially by 2030. The Purple Line would provide an alternative to automobile usage for those who work and live in the corridor, and thus could reduce the level of emissions from other vehicles.

Transit investments are very large capital and operating expenditures. It is clearly fiscally sensible to maximize the value of those investments by creating a system that will attract more riders by providing a reliable service that offers travel time comparable to or better than the automobile, and provide connectivity to other transit services.

Purpose and Need for Project

The purpose of the proposed project is to provide faster, more direct and more reliable east-west transit service in the Purple Line corridor, which would connect the four major activity centers, including the Metrorail services located there, to each other, and with the communities located between them. The existing and expected future roadway congestion in the corridor will have an increasingly detrimental effect on the travel times and reliability of east-west bus transit services in the corridor. The proposed Purple Line corridor transit improvements are intended to improve travel times and reliability by providing more direct services that will operate on dedicated and exclusive lanes and guideways.

Project Area



Summary of Alternatives

The AA/DEIS evaluates a No Build Alternative, a Transportation Systems Management (TSM) Alternative, and six Build alternatives. A range of Build alternatives has been examined, from modest investments in shared-use roadways, to major investments in a dedicated guideway, grade-separated where necessary, to determine which alternative achieves the greatest mobility and related benefits, balanced against costs and impacts on communities and the environment. Two modes, BRT and LRT, were identified during the public scoping process as the most appropriate for this project.

The No Build Alternative assumes that no new improvements would be made to the transportation system in the corridor, other than those that are currently in local and regional transportation plans and for which funding for implementation by 2030 has been planned. Thus it consists of the transit service levels, highway networks, traffic volumes, forecasted demographics for the horizon year of 2030 and planned transportation projects that are assumed in the Constrained Long Range Plan of the Metropolitan Washington Council of Governments.

The TSM Alternative would include improved bus service in the corridor, a new through-route from Bethesda to New Carrollton replacing the existing WMATA J4 route, and overlaying service on portions of the WMATA F4/F6 routes between College Park and New Carrollton. A combination of limited stops and selected intersection and signal improvement strategies would be the core of service improvements. Standard buses would be used.

The TSM and all of the Build alternatives extend the full length between the Bethesda Metro Station and the New Carrollton Metro Station. The intent is that these alternatives, while all serving the same markets and providing improvements in the quality of the transit service through improved operating speeds and reliability, vary in the type of running way (shared, dedicated, or exclusive) and amounts of grade separation (tunnel or aerial structure).

Bus Rapid Transit

BRT is a versatile, rubber-tired rapid transit mode that combines stations, vehicles, services, and guideway into an integrated system with a strong positive image and identity. BRT's system of facilities, services, and amenities collectively improve the travel time, reliability, and identity of traditional bus transit. BRT can operate on existing roads or on a separate guideway or busway. BRT stations are similar to those of a rail transit system. Low, Medium, and High Investment BRT Alternatives are being evaluated.

Low Investment BRT would operate in the corridor primarily on existing roadways in lanes shared with traffic. It would include some minimal amount of dedicated bus lanes or exclusive rights-of-way. This alternative would primarily use existing streets to avoid the cost of grade separation. It would incorporate signal, signage, and lane improvements such as queue jump lanes, in locations where such enhancements provide benefits and are appropriate to the larger transportation system. It would cross intersections at grade. This is the only alternative that would operate on Jones Bridge Road, directly serving the National Institutes of Health and the National Naval Medical Center at Rockville Pike and Jones Bridge Road.

The Medium and High Investment BRT would operate on the Georgetown Branch right-of-way and would include the construction of the Capital Crescent Trail between Bethesda and Silver Spring. Low Investment BRT would only operate on the Georgetown Branch right-of-way east of Jones Mill Road, and would include construction of the trail from that point east to the Silver

BRT on Wayne Avenue

Spring Transit Center.

Medium Investment BRT would operate in the corridor with a mix of shared lanes, dedicated bus lanes, and exclusive rights-of-way. This alternative uses these features where they provide maximum benefit relative to cost. Both Medium and High Investment BRT would operate in a counter-clockwise loop from the Georgetown Branch right-of-way onto Pearl Street, East West Highway, Old Georgetown Road, Edgemoor Lane, and Woodmont Avenue and from there onto the Georgetown Branch right-of-way under the Air Rights Building. The BRT stops at both the existing Bethesda Metro Station on Edgemoor Lane and at the new southern entrance to the Metro station under the Air Rights Building.

High Investment BRT would operate almost entirely in dedicated bus lanes and exclusive rights-of-way. It includes aerial structures and tunnels in areas of congestion to provide faster and more reliable service. Wherever there were measurable benefits and physical opportunity, the BRT would be separated from existing traffic. Tunnels would be used in Silver Spring, the University of Maryland, and between River Road and East West Highway in Riverdale Park. Crossings of most of the major radial roadways would be either on bridges or in underpasses.

Light Rail Transit

LRT is an electric railway system characterized by its ability to operate single cars or short trains along rights-of-way at ground level, on aerial structures, and in tunnels. LRT can operate in mixed traffic or in a separate right-of-way. Similar to BRT, Low, Medium, and High Investment Alternatives are being evaluated. Because of the operational limitations of LRT on steep grades, some portions of all three LRT alternatives would be in tunnel.

All LRT alternatives would operate on the Georgetown Branch right-of-way and would include the construction of the Capital Crescent Trail between Bethesda and Silver Spring.

Low Investment LRT would be primarily an at-grade rail line. It could operate in shared lanes for much of the alignment with minimal use of tunnels or aerial bridges and dedicated lanes. Tunnels and aerial structures would only be used where the topography results in grades too steep for LRT operations.

Medium Investment LRT would be in dedicated or exclusive lanes where possible or most beneficial, with some key areas grade-separated. The Medium Investment LRT is generally the same as Low Investment LRT from Bethesda to the CSX corridor, except that the alignment would cross over Connecticut Avenue on an aerial structure.

High Investment LRT would operate almost entirely in exclusive lanes. Portions of the alignment would be grade-separated, either on aerial structures or in tunnel. This alternative would be the same as the High Investment BRT Alternative, except for the Bethesda terminus where the alignment would begin just west of the tunnel under the Air Rights building and would not include the loop through downtown Bethesda. The western terminal station would be the Bethesda Metro Station with a connection to the southern end of the existing Metro Station platform. The hiker-biker trail would follow the alignment through the tunnel under the Air Rights building. Because of physical constraints, the trail would be elevated above the westbound tracks. The trail would return to grade as it approaches Woodmont Avenue.

East of the Silver Spring Transit Center all LRT Alternatives would operate on existing roadways or in tunnels. The amount of tunnel and exclusive or dedicated runningway would increase with the higher levels of investment.

Because of steep grades all LRT alternatives would be in tunnel from Wayne Avenue east of Manchester Road to Arliss Street, and all would pass under Adelphi Road at University Boulevard. The only exception to this is the Silver Spring/Thayer design option which does not use Wayne Avenue.

Ongoing Planning

The AA/DEIS presents a record of the planning for the Purple Line up to the current time; however, interaction with local communities, agencies, and other stakeholders continues, and ongoing studies may refine aspects of the alternatives, including possible additional design options. Two segments of the corridor under active study are the University of Maryland and the area east of downtown Silver Spring. Coordination with stakeholders will continue throughout the planning process and could modify aspects of the alternatives considered during the selection of the Locally Preferred Alternative. While six end-to-end alternatives have been defined and evaluated for the project, the ultimately selected Locally Preferred Alternative could be composed of an assortment of segments from alternatives at different levels of investment. Detailed descriptions of the alternatives are presented in the AA/DEIS.

LRT on Wayne Avenue

Impacts and Mitigation

All transportation projects have the potential to cause direct, indirect, or cumulative impacts to the social and natural environments. The Purple Line is anticipated to have beneficial impacts related to increased mobility and improved access to activity centers along the corridor, and minimal adverse impacts primarily related to potential noise and visual effects to communities. Findings of the analysis of impacts conducted on environmental features in the corridor are briefly summarized below.

Communities

Community effects considered include residential property displacements and acquisition, access, mobility, parking, community cohesion, visual effects, community facilities, and noise.

The No Build and TSM Alternatives would not require property acquisitions. The Build alternatives would require between 3 and 12 residential properties, depending on the Alternative. Strip takes along some segments of the alignments would be required under each of the Build alternatives.

The TSM and Build alternatives would improve mobility and access for all of the communities, including access to community facilities.

There no impacts to public parking anticipated as a result of the No Build and TSM Alternatives, although increased traffic volumes in the future may result in the reduction or elimination of

parking on the increasingly congested roadways. Each of the Build alternatives is anticipated to require expanded restrictions to public parking in some locations and elimination of some public on-street parking spaces.

The No Build and TSM Alternatives would not affect neighborhood cohesion. Increasing traffic levels resulting from increases in population and economic development independent of the Purple Line may adversely impact neighborhoods. The only place the Purple Line would affect community cohesion is along the Georgetown Branch right-of-way where the currently unrestricted crossing of the trail would be restricted to specific locations. This would occur under all the Build alternatives except Low Investment BRT.

Environmental Justice

The adverse effects of the Build alternatives are not disproportionately borne by environmental justice populations.

The Purple Line benefits of improved mobility and accessibility to locations in the corridor and other transit service are largely a function of the station locations. The Purple Line station locations were selected based on the density of development, the presence of activity centers, the location of stops of other transit services to provide convenient transfers, and high levels of transit ridership. The stations are distributed along the corridor and serve all communities, including environmental justice communities. Therefore, environmental justice populations will not be denied the benefits of the Purple Line.

Full and fair access to meaningful involvement by low-income and minority populations in project planning and development is an important aspect of environmental justice. Participation by low-income and minority populations in the Purple Line decision-making process has been advanced by: expanded outreach to environmental justice communities; meetings with community leaders; city and county agency staff, and local elected officials; and the translation of project newsletters, fact sheets, and Open House announcement posters into Spanish.

Cultural Resources

The Purple Line Build alternatives could adversely impact one eligible historic standing structure resource, and four archaeological sites. Should a Build Alternative be selected, a detailed analysis of impacts on cultural resources will be conducted. Avoidance and minimization will be considered wherever feasible. Should adverse effects occur an appropriate mitigation plan will be developed by the MTA in coordination with the Maryland Historical Trust and other consulting parties, as appropriate. The No Build and TSM Alternatives are not anticipated to impact cultural resources.

Visual Effects

The No Build and TSM Alternatives are not anticipated to have visual effects. Visual impacts are not anticipated under the No Build and TSM Alternative. Visual impacts will occur under each of the Build alternatives. Primary visual impacts of concern are to those locations where transit is being introduced including along the Georgetown Branch right-of-way, on Thayer Avenue and Piney Branch Road for the Silver Spring/Thayer Avenue design option, and along the Preinkert/Chapel Drive design option through the University of Maryland campus. Mitigation measures would be made in coordination with local communities and jurisdictions should a Build Alternative be selected. Minimization and mitigation could include landscaping, fencing, or other screening such as earth berms, roadway surface treatments, use of existing poles or buildings to support the trolley wires or new signage, and architectural treatments of structures.

Parks, Recreation, and Open Space

The No Build and TSM Alternatives are not anticipated to effect parks, recreations area, or open space. Of the 53 public parks, recreation, and open space areas in the corridor; eleven parks, five open space areas (schools) and five trails are anticipated to be impacted by a Build Alternative. Individual park impacts are all less than an acre. Total impacts to parks from the Build alternatives range from 8.77 acres for Medium Investment BRT (with the Preinkert/Chapel Drive design option) and 16.15 acres for Low Investment BRT. A majority of this acreage is open space or recreation areas on the University of Maryland campus. The University has plans to redevelop some of this acreage as part of their master plan. It is anticipated that these impacts would be minimized during later stages of the planning process.

The development of early resource inventories and conceptual engineering activities to keep the transit alignment within existing rights-of-way as much as possible, helped to avoid or minimize the impacts on many of the public parks and recreation areas in the corridor. The potential impacts are not expected to alter the use or function of the parks or impede access. The Purple Line would benefit park users by providing direct access to the parks by transit. Subsequent engineering activities would seek to further minimize impacts whenever practical. De minimis impacts on publicly-owned parks, recreation areas, and open space are defined as those that do not “adversely affect the activities, features and attributes” of the Section 4(f) resource. The MTA intends to pursue a finding of de minimis impact to the parks, recreation areas, and open spaces in the corridor that have potential impacts from the Build alternatives.

Air Quality

The Purple Line is not predicted to cause or exacerbate a violation of the national air quality standards and is not expected to measurably increase regional emission burdens or Maryland state levels. The Purple Line is also not expected to violate the $PM_{2.5}$ standard.

Noise and Vibration

The No Build and TSM Alternatives are not anticipated to have noise or vibration impacts. Moderate noise impacts from transit line operations are anticipated to result from BRT alternatives in Silver Spring along the CSX corridor, on Wayne Avenue, and on Arliss Street. The LRT design includes vehicle skirts that substantially minimize noise impacts. Therefore, no noise impacts are anticipated from LRT line operations. The Lyttonsville maintenance and storage facility would have moderate noise impacts from BRT, and no impacts from LRT. The Glenridge facility would have severe noise impacts from LRT only. Noise impacts at both facilities could be eliminated by the construction of noise walls between the facilities and the adjacent residential areas.

Habitat and Wildlife

The No Build and TSM Alternatives are not anticipated to impact wildlife resources. Impacts to wildlife resources by any of the Build alternatives are anticipated to be minor, and any wildlife corridors, especially within stream valley parks, would be maintained. Areas of forest interior habitat occur within the Rock Creek stream valley, the forested area east of Northwest Branch, north of University Boulevard, and north of Campus Drive within Paint Branch Stream Valley Park. The Purple Line would follow an existing trail or existing roadways through these habitat areas creating

minor encroachment impacts necessary to accommodate the transitway.

Significant trees were not specifically identified within the project corridor during this stage of the planning process. However, forested areas and neighborhoods with street trees that appeared to contain a number of significant trees were mapped for identification, delineation, and surveying following the selection of a Locally Preferred Alternative.

Potential effects to aquatic habitat and water quality would be minimized by strict adherence to sediment and erosion control plans and stormwater management plans, which would be developed in accordance with state regulations to provide long-term mitigation of potential effects from stormwater.

Rare, Threatened, or Endangered Species

Based on information provided by Maryland Department of Natural Resources (DNR) and the U.S. Fish and Wildlife Service, no state or federally known rare, threatened, or endangered species are present within the corridor.

Groundwater and Hydrogeology

The No Build and TSM Alternatives are not anticipated to affect groundwater or hydrology in the corridor. The Low and Medium Investment BRT and LRT Alternatives and the proposed maintenance and storage facilities are not expected to substantially affect groundwater. These alternatives and the maintenance and storage facilities would be completely constructed on the ground surface and only minor changes to the movements of the shallow groundwater table are likely during grading and construction. Any runoff would be treated in accordance with Maryland Department of the Environment (MDE) guidelines for stormwater management and released to surface waters. The tunnel components of the LRT and High Investment BRT Alternatives could affect groundwater by potentially causing a minor change in localized groundwater paths. These minor changes, however, are not expected to affect overall groundwater flows or quantities.

Surface Water

The No Build and TSM Alternatives are not anticipated to impact surface water. All of the Build alternatives and maintenance and storage facilities could increase levels of certain contaminants within the affected subwatersheds. These increases are expected to be greatly minimized with the use of approved sediment and erosion control measures during construction and implementation of stormwater best management practices, as required by MDE.

Scenic and Wild Rivers

The No Build and TSM Alternatives are not anticipated to impact scenic and wild rivers. All of the Build alternatives are anticipated to have minimal impacts to streams designated as scenic and wild because impacts are primarily associated with extensions of existing bridges and culverts to accommodate the BRT and LRT Alternatives rather than new stream crossings. Any impacts to Scenic and Wild Rivers will be evaluated as part of DNR's environmental review process for the project. Tributaries to Scenic and Wild Rivers in the corridor include: Little Falls, Sligo Creek, Northwest Branch, Northeast Branch, and Lower Beaverdam Creek.

Floodplain

The No Build and TSM Alternatives are not anticipated to impact floodplains in the corridor. The placement of substantial amounts of fill in floodplain areas is not anticipated for the at-grade components of the Build alternatives. However, fill may be placed in the 100-year floodplain in areas where the existing road berm may need to be extended to support the placement of aerial structures and the construction of grade separations. No impacts to 100-year floodplains are anticipated from the maintenance and storage facilities. Construction within the 100-year floodplain will require a Waterway Construction Permit from MDE.

Waters of the United States, including Wetlands

Impacts to Waters of the US, including wetlands, are not anticipated from the No Build or TSM Alternatives. Impacts from each of the Build alternatives range from one acre for the Low Investment BRT to 1.4 acres for Medium Investment LRT Alternatives. Effects to nontidal resources may require a Maryland Nontidal Wetlands Permit, a Section 401 Water Quality Certificate, and/or a Waterway Construction Permit from MDE, as well as a Section 404 permit from the U.S. Army Corps of Engineers for the discharge of dredged or fill material into Waters of the U.S., including wetlands. Anticipated wetland impacts at either of the maintenance and storage facilities are minimal.

Topography

The No Build and TSM Alternatives are not anticipated to impact the topography of the corridor. Topographic impacts from each of the Build alternatives and their associated design options are expected to be minimal. Minimal grading would be required for the Lyttonsville maintenance and storage facility; however, the Glenridge facility is located on a steep hillside that would require extensive grading and fill to accommodate the infrastructure of a maintenance and storage facility.

Geology

Effects on geology in the corridor from the alternatives only apply to those sections of the alignments that involve tunneling, the High Investment BRT and all the LRT Alternatives. The No Build, TSM, Build alternatives, and maintenance and storage facilities that involve only surface construction would have little or no effect on geology. All of the tunnel options could change the geologic resources in the corridor, although these changes would be limited to the tunnel section itself, where rock or Coastal Plain deposits would be bored and removed for construction of the tunnel.

Soils

Because of the urbanized nature of the corridor, the majority of soils potentially affected by the project have already been disturbed, manipulated, or covered by development. No additional soil disturbances are anticipated for the No Build and TSM Alternatives. Additional soil disturbances would occur for all of the Build alternatives and maintenance and storage facilities, due to grading. Other potential impacts that could occur with any of the Build alternatives include changes to drainage patterns within or adjacent to the right-of-way. However, these effects should be minimal and will be reduced by required stormwater management facilities.

Hazardous Materials

An Initial Site Assessment identified 107 properties of relatively high potential for concern within the corridor. Such properties include automobile service stations that store and handle petroleum products and solvents. These sites may be impacted by right-of-way takes and would be investigated further should a Build Alternative be selected. This initial assessment does not preclude future use of these properties.

Safety and Security

Given that the streets along which the Build alternatives would operate already generally have high frequency bus operations, the types of conflicts among traffic, transit, and pedestrians under any alternative would be similar to

conditions existing today. Traffic and transit controls would be used to manage any potential conflicting movements. The proposed transit facility would be designed to be compatible with the safe and secure use of the planned trails, as has been the experience for similar facilities elsewhere. Tunnel portals would be designed to incorporate safety features appropriate to their locations.

Utilities

The construction of the transitway in a street will have little impact on deep utilities.

Comparison of Benefits and Costs

Several other considerations play a role in the evaluation of the alternatives. First, because any transportation improvement must be a cost-effective investment, each alternative has been evaluated in terms of benefits produced compared to costs incurred. Second, because the transit farebox receipts generated by a transit service would be insufficient to cover its costs, the study identifies the potential need for, and sources of, additional funding for the capital, operating, and maintenance costs of each alternative. This could include various combinations of federal, state, local, and private sources. Finally, any transportation solution would be developed to be as environmentally sensitive and compatible with the natural, human, and built environments as possible. Any unavoidable adverse impacts would be minimized and appropriately mitigated.

Benefits, costs, and effects may be distributed unevenly across the population; therefore, the study examined alternatives in terms of who benefits, who pays, and who is subject to adverse effects. The framework for the evaluation involves the following:

- Effectiveness – how well each alternative addresses the purposes of the project
- Cost-effectiveness – the extent to which an alternative provides a level of benefits that is commensurate with its cost, and relative to the other alternatives
- Financial feasibility – the extent to which sufficient funding is available or can be developed to construct, operate and maintain the alternatives
- Equity – how well each alternative provides a fair distribution of costs and benefits to the various subgroups and communities in the corridor

As noted earlier, improvements to the transportation system in the corridor need to address the transportation challenges of traffic congestion, slow transit travel time, limited mode options, and degraded mobility and accessibility, and poor transit system connectivity.

Through extensive community and stakeholder outreach and the AA/DEIS technical analyses, a set of objectives and evaluation measures were developed for use in selecting the preferred transit investment in the corridor. These efforts identified that the consideration of transit improvements in the corridor was driven by factors beyond just mobility, accessibility, and transit operating efficiencies to include support for local plans for economic and community development, environmental quality, and optimizing public investment. These can be summarized as follows:

- Increase mobility and improve accessibility
- Improve transit operations efficiencies
- Enhance environmental quality
- Optimize public investment
- Support local plans for economic and community development
- Contribute to attainment of regional air quality standards

It is expected that Federal Transit Administration (FTA) funds would be sought if one of the Build alternatives is selected for implementation. Therefore, the goals and objectives in part reflect the evaluation criteria established by the FTA for potential projects eligible for funding under the Section 5309 New Starts process. This is a competitive process whereby communities across the country compete for federal financial assistance in starting a new transit project. The federal criteria and measures related to justifying the project are: mobility improvements; environmental benefits; operating efficiencies; cost effectiveness; transit-supportive land use and future patterns; and other factors.

In addition to the criteria above, the FTA considers the community's capacity to finance the proposed project. FTA has established a number of measures that help the community assess financial capacity, including the following:

- Stability and reliability of capital financing plan
- Stability and reliability of operating financing plan
- Local share of proposed costs

The issue of financial capacity is not directly applicable to the evaluation of the merits of the specific alternatives and ranking one alternative above another; however, it can affect a decision on the overall affordability of an alternative if its cost of construction or operating and maintenance exceed likely available financial resources. It underscores the importance, as expressed in the project justification criteria related to operating efficiency and cost-effectiveness, of minimizing the costs of the alternatives relative to the transportation benefits they provide to the region.

Attainment of Goals and Objectives

A series of objectives were developed to support the project goals. The objectives were based on FTA New Starts guidelines and input from local agencies, stakeholders, and members of the public. Specific means of addressing the performance of the various alternatives in regards to how well each does (or does not) perform with respect to the goals include a mix of quantitative measures of effectiveness and cost effectiveness, and qualitative assessments. The sources for these measures were Maryland Department of Transportation (MDOT)/MTA, FTA New Starts Criteria, county and local jurisdictions and agencies, and corridor-specific needs and issues. The key measures, especially those that contribute substantially to differentiating between alternatives, are summarized herein. This information is discussed in regard to effectiveness, cost effectiveness, financial feasibility, and equity and summarized in the Summary table.

Effectiveness

Increase mobility and improve accessibility

The corridor has four major activity centers, Bethesda, Silver Spring, College Park, and New Carrollton, each with a substantial employment base and surrounding residential concentration and each with a Metrorail Station. Other key activity centers are the University of Maryland campus with 36,000 students and 12,000 employees; and the Takoma Park/Langley Park area. The corridor is fully developed with residential communities of varying income levels. They all share a characteristic of relatively high transit usage and low automobile ownership – many by choice because of the transit access and connectivity provided by the Metrorail system and extensive bus systems. While fast and reliable transit service is provided

by the Metrorail into Washington, DC and other activity centers along these radial routes, the transit service in the Purple Line corridor is hampered by slow and unreliable operations because it operates over a congested and indirect roadway network and often requires transfers between multiple transit routes and operators.

By 2030 and beyond, under the No Build conditions, the roadway congestion will increase due to population and employment increases, and vehicular trip growth, all of which will worsen transit travel times and reliability along this corridor. While Metrorail does provide some connectivity options for these trips, it requires taking circuitous routings into downtown Washington, DC and back out again. Several communities in the corridor, especially the Takoma-Langley Park area, are in a wedge between the Metrorail lines and do not even have this option.

The TSM Alternative would provide a bus service that would operate as a single route for the entire corridor length and would not make as many local stops to improve travel times between the major activity centers. However, this service would be hampered by the same increasingly congested roadway conditions as the current and future No Build bus services.

Because they would have similar alignments and stations, all the Build alternatives, as well as the TSM Alternative, would serve essentially the same travel markets: providing access to the major activity centers in the corridor, especially the Metrorail and MARC services located at Bethesda, Silver Spring, College Park, and New Carrollton. The alternatives differ in the travel times and reliability they would provide. High Investment LRT provides the fastest travel times along the corridor because of its higher investment in tunnel segments that provide a travel time advantage over surface alignments. By providing less grade separation or less exclusive surface running operating environments, Low and Medium Investment LRT would have slower travel times than High Investment LRT. The LRT alternatives would have faster end-to-end travel times than their BRT counterparts. West of Silver Spring, the BRT alternative travel times are longer than their LRT counterparts because of routing differences. Because of the need to turn the buses around, the westbound High and Medium Investment BRT would operate in a loop, leaving the Georgetown Branch right-of-way at Pearl Street operating on surface streets in downtown Bethesda, then returning to the Georgetown Branch right-or-way from Woodmont Avenue and continuing under the buildings on either side of Wisconsin Avenue. This would decrease the operating speeds of these alternatives. While this slower travel time would degrade the market attractiveness relative to the LRT alternatives for trips connecting to Bethesda Metrorail Station, these two alternatives would actually provide better access to the downtown Bethesda employment market. Low Investment BRT and the Medium Investment BRT variation via Jones Bridge Road, because of their routing along Jones Bridge Road and Woodmont Avenue, would have the slowest travel times between Silver Spring and downtown Bethesda although they would provide a direct connection to the National Institutes of Health/National Naval Medical Center area. However, these travel markets are already served by a number of transit services and are comparably or even better served by the other Build alternatives which use the Georgetown Branch right-of-way.

As the result of having similar alignments, station locations, and service plans, the attractiveness of the Build alternatives to the transit markets and the resulting user benefits would primarily be a function of the travel time improvement differences among the alternatives. The LRT Alternatives would attract more riders and new transit trips than the TSM and BRT Alternatives and would generate more user benefits. The High Investment alternatives under LRT and BRT would produce higher numbers of riders, new transit trips, and user benefits than their respective Medium and Low Investment Alternative counterparts or the TSM Alternative.

Due to the similarity of service, the number of residents, employees, transit-dependent populations, and zero-car household populations served by the alternatives would be virtually the same and therefore are not a differentiating factor among the alternatives.

For the same reason, transferring and interconnectivity to Metro, MARC, Amtrak, and bus services are not a differentiating factor among the alternatives, except that the BRT Alternatives would provide better connectivity with the existing bus facility at the Bethesda Metrorail Station.

In summary, High Investment LRT would be the most effective in addressing the mobility and accessibility objectives.

Improve transit operations efficiencies

When transit vehicles operate in mixed traffic or shared roadways, including traversing roadway intersections, the potential for delays increases. This in turn decreases the reliability of the service and lessens operational efficiency. Because of the investment in tunnel segments, grade separations, and dedicated lanes, High Investment BRT and LRT would provide the most efficient and reliable operations. Low and Medium Investment BRT and LRT would provide these benefits to a lesser degree.

Service with improved operating speeds enables more efficient operations as it requires fewer vehicles and operators to provide the transit service. The BRT Alternatives would have lower operating costs than the LRT Alternatives. However, further refinement of the services' operating plans relative to the ridership demand level may lessen these differences. The incremental cost of adding more service is less for the LRT Alternatives than for the BRT Alternatives.

With the introduction of any one of the BRT or LRT Alternatives, as well as the TSM Alternative, there would be opportunities to adjust the existing and future bus network in the corridor in response to service redundancies, thereby reducing operating costs to the transit providers. These reductions would be similar across all alternatives.

Enhance environmental quality

All of the alternatives generally follow existing roadway or railroad rights-of-way. As a result, the environmental and community impacts are relatively minor in type and degree for projects of this nature. The roadways along which the alignment would run typically have high volumes of automobile, truck, and bus traffic operating along them.

The LRT and High Investment BRT Alternatives would have some tunnel segments, which would in certain instances run below ground under residential and commercial properties. The effects on the surface structures and communities would be negligible. The tunnel portals and tunnel vent and emergency exit shafts, where required, would be the most noticeable features.

Because all the alternatives would have similar alignment characteristics, impacts on parks, wetlands, historic properties, residential and business properties and other environmentally sensitive sites would be very similar between the alternatives, and are thus unlikely to be a key differentiating factor among the alternatives.

Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure		No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Increase Mobility and Improve Accessibility										
• Improve accessibility to existing and planned economic development areas in the corridor • Improve access to jobs in corridor • Increase employers' access to labor pool	• User Benefits by Alternatives, 2030 (daily minutes)		--	401,200	623,700	851,200	994,200	1,033,700	1,098,200	1,211,8000
	• Percent over TSM		--	--	56%	112%	148%	158%	174%	202%
	• User Benefits with Mode-Specific Attributes by Alternatives, 2030 (daily minutes)		--	401,200	702,300	1,022,200	1,258,000	1,180,600	1,303,800	1,489,600
	• Percent over TSM		--	--	75%	155%	214%	194%	225%	271%
	• Accessibility of residents to employment: jobs within ¼ to ½ mile of stations • Accessibility of employers to workers: households within ¼ to ½ mile of stations		All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor among the alternatives.							
• Reduce travel time between activity centers:	• Peak transit travel times for alternatives in 2030 (minutes)	Current								
o Bethesda – Silver Spring		20	35	33	25	19	19	12	9	9
o Bethesda – Takoma/Langley Park		38	65	61	51	38	33	29	26	23
o Bethesda – UM Campus Center		49	81	76	66	49	40	38	34	30
o Silver Spring – Takoma/Langley		19	31	29	26	19	14	18	17	14
o Silver Spring – Riverdale Park		44	67	62	59	43	33	39	38	32
o Silver Spring – UM Campus Center		29	47	44	41	30	22	26	25	21
o Silver Spring-College Park Metro		36	56	53	52	36	28	32	31	27
o Takoma/Langley – Riverdale Park		25	36	34	33	24	19	22	22	19
o East Silver Spring – Silver Spring		5	8	8	8	7	5	7	7	4
o East Silver Spring – Takoma Langley		14	23	21	19	13	10	11	11	10
o New Carrollton – Riverdale Park		11	15	12	13	13	10	13	13	10
o New Carrollton – University of Maryland		25	35	30	31	25	21	25	25	21
o New Carrollton – Silver Spring		54	81	73	72	55	43	51	50	42
• Improve mobility for transit-dependent households	• Number of zero-car households within ¼ mile of stations		All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor among the alternatives.							
Improve Transit Operations Efficiencies										
• Increase interconnectivity of transit system, including bus-to-bus and bus-to-rail transfers	• Number of routes connecting at major transfer points		All alternatives have very similar station locations and connectivity to other transit services. Therefore, this connectivity measure is not a differentiating factor among the alternatives.							
• Integrate radial Metrorail and MARC lines for better transit system connectivity (also see below under Increase regional transit usage)	• Transfer walk time • Number of transfers required to access major activity centers		All alternatives have very similar service plans and station locations. Therefore, these transfer measures are not a differentiating factor among the alternatives, except that the BRT alternatives provide better connectivity with the existing bus facility at the Bethesda Metro Station.							
• Increase reliability of transit service	• Comparison of running way characteristics (miles):									
	o Dedicated		All shared	All shared 15.97	0.67	7.4	7.71	8.62	9.18	8.88
	o Exclusive				1.97	4.85	9.37	5.73	5.74	8.81
	o Shared (with traffic)				14.43	4.68	0.15	1.76	1.33	0.16

Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure	No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
	• Comparison of vertical alignment type (miles):								
	o Aerial	All surface running	All surface 15.97	--	1.26	1.63	1.06	1.06	1.73
	o Surface			17.07	15.66	12.99	14.39	14.5	12.9
	o Tunnel			--	0.01	2.61	0.66	0.69	3.22
• Increase regional transit usage • Integrate radial Metrorail and MARC lines for better transit system connectivity	• Transit ridership (daily boardings)								
	o Purple Line	--	14,800	22,200	29,300	33,800	32,500	33,900	36,100
	o Purple Line via Metrorail	--	2,100	16,700	21,100	23,700	25,300	27,200	30,500
	o Purple Line via MARC	--	--	1,100	1,400	1,400	1,500	1,500	1,500
	Total	--	16,900	40,000	51,800	58,900	59,300	62,600	68,100
	New transit trips relative to No Build	--	8,200	11,400	15,300	17,700	18,200	19,200	20,500
	Percent new trips relative to No Build	--	--	14%	25%	29%	31%	32%	35%
• Reduce transit travel times in the corridor	• Change in operating speeds of transit service	--	9	10	13	16	15	16	19
	• Change in travel time between major activity centers	See objective "reduce travel time between activity centers" above.							
	• End-to-end peak period running times Bethesda to New Carrollton (minutes)	--	108	96	73	59	62	59	50
• Serve transit-oriented populations	• Number of zero-car households within ¼ and ½ mile of stations	All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor between alternatives.							
Enhance Environmental Quality									
• Minimize and mitigate impacts to the natural and human environment in the corridor • Provide a safe and attractive transit service that is compatible with local community character	• Direct impacts to natural resources	• All alternatives have very similar alignments and station locations, and as a result, the natural environment impacts are not appreciably different between alternatives. The Build alternatives would impact between 1 and 1.4 acres of wetland, 13.5 to 15.1 acres of floodplains, and 3,892 to 5,719 linear feet of stream.							
	• Direct impacts to parklands	• Up to 11 parks, five open space areas (schools) and five trails, could potentially to be impacted by a Build Alternative. • Individual park impacts are all less than an acre. Total impacts from the Build alternatives range from 1.98 acres for Low Investment LRT to 3.02 acres for Medium Investment BRT. • Individual open space (public school) impacts range from 0.05 acre to 1.65 acres except for impacts to the University of Maryland, which range from 7.02 acres to 13.91 areas. Total impacts to open space from the Build alternatives range from 7.38 acres for Medium BRT Preinkert/Chapel Option to 14.46 acres for Low Investment BRT. • Individual trail impacts range from 0.02 acre to 1.67 acres. Total impacts from the Build alternatives range from 1.29 acres for High Investment BRT Silver Spring/Thayer Option to1.85 acres for Medium Investment LRT.							
	• Direct impacts to historic properties	• All BRT and LRT alternatives except Low Investment BRT could impact one historic standing structure resources, the Falkland Apartments.							
	• Visual effects.	• All alternatives have nearly identical alignments and station locations and result is similar visual effects, with the most substantial visual effects being along the Georgetown Branch right-of-way. The Preinkert/Chapel Drive and Silver Spring/Thayer Avenue design options would present additional substantial visual effects.							
	• Direct residential property impacts (number of displacements)	• All of the Build alternatives require residential displacements. • Low Investment BRT has the fewest displacements (three single-family homes) while the High Investment BRT and LRT alternatives have the most residential displacements (ten single-family houses, several units from three buildings of two apartment complexes, and one duplex).							

Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure	No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Optimize Public Investment									
• Demonstrate that the overall benefits of the transit improvements warrant their capital and operating costs	• Total capital cost ($2007 in million)	--	$82	$386	$580	$1,088	$1,206	$1,220	$1,635
	• Annual operating and maintenance costs ($2007 in millions)	--	$14.6	$17.3	$17.3	$15.8	$26.4	$25.0	$22.8
	• Annual increase in operating subsidy ($2007 in millions)	--	$12.2	$14.0	$12.8	$10.6	$21.1	$19.4	$16.0
	• FTA cost-effectiveness measures (cost per hour of User Benefit)	--	--	$18.24	$14.01	$19.34	$26.51	$22.82	$23.71
	• Annualized cost per new rider relative to No Build	--	$8.98	$14.49	$14.29	$19.76	$22.96	$21.72	$24.57
Support Local Plans for Economic and Community Development									
• Support local, regional, and state policies and adopted master plans	• Consistency with local, regional, and state policies and adopted master plans	• Only the LRT alternatives support the Montgomery County Master Plan, which calls for LRT between Bethesda and Silver Spring, with a trail along the Georgetown Branch right-of-way. All Build alternatives would support the Montgomery County Master Plan by constructing the permanent Capital Crescent Trail, although the Low Investment BRT alternative would not build the permanent trail west of Jones Mill Road. The Prince George's County Master Plan supports the Purple Line in general, but does not identify a specific alignment. Both Montgomery and Prince George's Counties are in the process of developing functional master plans for the Purple Line.							
• Support potential for transit-oriented development at existing and proposed stations in support of local land use plans	• Number and size of transit-oriented development opportunities • Potential for new development	• All alternatives have nearly identical alignments and station locations and similar volumes of service. Therefore, these development measures are not a differentiating factor among the alternatives except Low Investment BRT, which would not support the planned transit oriented development at Chevy Chase Lake. High Investment BRT and LRT would not have a station at Fenton Street, would therefore not support transit-oriented development at this location.							
Support Attainment of Regional Clean Air Goals									
• Support attainment of regional air quality goals	• Change in regional emission burden	--	All alternatives produce small but beneficial changes in regional emissions						

In some specific instances, the impacts are seen by some in the local communities as onerous – specifically the change in the character of the Georgetown Branch railroad right-of-way along which the Interim Georgetown Branch Trail is located. The re-introduction of rail operations with the LRT alternatives, in conjunction with the construction of the permanent Capital Crescent Trail segment, as called for in the Montgomery County Master Plan for several decades, or the introduction of BRT, would remove the trees within the right-of-way. The trees and vegetation on the properties abutting the right-of-way would be expected to remain and would maintain much of the tree cover and visual character. The design features and character of the transitway and trail are incorporated to mitigate these concerns. Some in the communities along certain street alignments, specifically Wayne Avenue, have concerns about LRT or BRT vehicles operating on the surface along this street adversely affecting the character of the street and adjoining neighborhoods. Others in the community view the introduction of these transit vehicles as compatible with the community character given that Wayne Avenue is already used by automobile, truck, and bus traffic.

Optimize public investment

Transportation system user benefits, community and economic benefits, and environmental benefits would be generated by all the BRT and LRT alternatives to varying degrees depending on the specific attributes of the alternatives. These benefits would generally increase with increased levels of public capital investment. Ongoing public investment in operating and maintenance of the transit service would also be required. All the alternatives generate benefits and support a number of public objectives.

One measure that is useful for the comparative evaluation of the alternatives to show the degree of increased user benefits for increasing level of capital and operating costs is the FTA New Starts cost-effectiveness measure. Based on this measure, the BRT alternatives would be slightly more cost-effective than the LRT Alternatives, with Medium Investment BRT being the most cost-effective. The Medium Investment LRT Alternative is the most cost effective of the LRT Alternatives. This demonstrates that the added investment in providing facilities that improve the operating speed and therefore the travel time for the Medium Investment Alternative generates more benefits relative to the costs than the Low Investment Alternatives. However, the incremental costs of providing additional facilities in the High Investment Alternatives relative to the Medium Investment Alternatives generate a diminishing rate of benefits.

Support economic and community development

All alternatives except the No Build would generally support the established county master plans and the state Smart Growth policies. Only the LRT Alternatives support the Montgomery County Master Plan which calls for LRT with the permanent Capital Crescent Trail along the Georgetown Branch right-of-way. All of the Build alternatives except the Low Investment BRT would support the Montgomery County Master Plan by constructing the full final segment of the permanent Capital Crescent Trail.

The master plans of Montgomery and Prince George's County target communities and areas along the Purple Line Corridor for economic and community development. They cite improved transit service and access as a supportive measure for achieving this development. For example, the Maryland-National Capital Park and Planning Commission/Redevelopment Authority of Prince George's County/City of Takoma Park *Community Development Initiatives in the University Boulevard Area* identifies the Purple Line as a supportive project for achieving this development.

All alternatives have nearly identical alignments and station locations and similar volumes of service and would support the established economic and community development plans of the counties and local jurisdictions along the corridor. Therefore, these development measures are not a differentiating factor among the alternatives.

Contribute to attainment of regional air quality standards

All BRT and LRT Alternatives would attract automobile trips to transit, reducing automobile-generated mobile-source air pollutant emissions. Transit service is more fuel efficient and less polluting than automobile travel. High Investment LRT would attract the most automobile trips to transit. The LRT Alternatives attract more automobile trips to transit than the BRT Alternatives.

Cost-Effectiveness

The cost-effectiveness analysis is a mechanism comparing the total costs of a project to its benefits. A key measure used to determine the relative advantages of proposed transit systems is known as the cost-effectiveness index. This index is used to measure the benefits that users experience as a result of a new transit improvement, such as LRT or BRT service, compared with a TSM Alternative.

The Summary table presents the cost-effectiveness index for the alternatives. User benefits can accrue to users of fixed guideway transit services due to attributes of these systems not reflected strictly in terms of travel times and out-of-pocket costs. These are referred to as mode-specific attributes. The degree to which these additional benefits accrue to the users depends on the definitions of the alternatives, including the guideway characteristics of the transit modal technologies. These would accrue to all the BRT and LRT Alternative users to varying degrees depending on the specific attributes of the alternative. The measure is very useful in the AA/DEIS for the comparative evaluation of the alternatives to show the degree of increased user benefits for increasing level of capital and operating costs. The lower the number, the more cost-effective the alternatives under this particular method are. It is also useful for assessing the potential for New Starts funding.

Mode-Specific Attributes

These attributes account for perceived benefits that users feel they receive for amenities, comfort, reliability, safety and other characteristics of the mode.

The results in the Summary table indicate that the BRT Alternatives are slightly more cost-effective than the LRT Alternatives, with the Medium Investment BRT Alternative being the most cost effective under this measure. Medium Investment LRT is the most cost effective of the LRT Alternatives. This demonstrates that the added investment in providing facilities that improve the operating speed and therefore the travel time for the Medium Investment Alternative generates more benefits relative to the costs. However, the incremental costs for providing additional facilities in the High Investment Alternatives relative to the Medium Investment Alternatives generate a diminishing rate of benefits.

FTA defined ranges for rating projects submitted for FTA consideration for New Starts funding. These ranges are updated occasionally to account for cost escalation and other such factors.

Currently, a measure above $30.00 per hour is rated "Low," between $24.00 and $30.00 per hour is rated "Medium-Low," between $23.99 and $15.50 per hour is rated "Medium," between $15.49 and $12.00 is rated "Medium-High," and under $12.00 per hour is rate "High." These will likely change by the time that a Purple Line Locally Preferred Alternative would be submitted to FTA for rating. All the alternatives would fall into the "Medium" range except for the Low Investment LRT which would fall into the "Medium-Low" range. For New Starts purposes at this point, an alternative should have a "Medium-Low" rating and preferably a "Medium" rating.

Financial Feasibility

Considerations of financial feasibility are based on the magnitude of the overall cost of the proposed transit improvements compared to the capacity of various funding programs available to fund it. The overall costs include both initial capital costs and the on-going costs of operations and maintenance. The funding sources include fare revenue from additional riders, federal programs, such as the FTA's New Starts program, State of Maryland funding, county and other sources, including private funding.

The proposed alternatives differ significantly in both capital and operating cost, ranging from a relatively minimal cost for the TSM and Low Investment BRT Alternatives to more than $1 billion in capital costs and significant annual operating costs for the High Investment BRT and LRT Alternatives. However, for the purposes of the AA/DEIS evaluation, all of the alternatives are potentially feasible provided that they generate sufficient transportation benefits to meet the requirements of the relevant federal and state funding programs.

Equity

Equity considerations generally fall within three classes:

- The extent to which the transit investments improve transit service to various population segments, particularly those that tend to be transit-dependent
- The distribution of the cost of the alternatives across population segments through the funding mechanism used to cover the local contribution to construction and operation
- The incidence of any significant environmental effects, particularly in communities immediately adjacent to proposed facilities

As discussed below, the mobility and accessibility, economic and community development, and environmental benefits of the Purple Line alternatives generally accrue to the residents of the corridor as well as to the Washington metropolitan region, while the relatively few adverse effects are borne primarily by those persons residing in the corridor. Established regional and federal funding mechanisms will be used for construction and operation of the selected alternative, and new funding sources will be used to prevent diversion of resources (funding, service, or infrastructure) from other parts of the region.

Service Equity

All of the proposed alternatives except the No Build, and including the TSM, would improve both the travel time and the reliability of the transit service in the corridor. The proposed alternatives would function as both a line haul service connecting the major activity centers and communities along the corridor, and as a "collector-distributor" for trips using the Washington, DC area's extensive regional transit system, including the Metrorail, MARC, Metrobus, and local transit services operating in the two counties, and as an intra-corridor service for trips generated within the corridor. All alternatives would provide improved access to the corridor's employment centers; educational facilities; health centers; and institutional, cultural, recreational, entertainment, open space, retail, and governmental resources. No one group would receive a disproportionate share of these benefits to the detriment of another group.

Financial Equity

If a Build Alternative is selected, it is expected that it would be financed by a combination of federal, state, and local funds. The existing funding structures of the MDOT/MTA, Montgomery and Prince George's Counties, and WMATA will continue to fund existing services and capital programs throughout the region. A combination of new federal, state, and local funding and, potentially, new sources of local funds, including new taxes, could be employed. The use of established federal and regional sources means no one group in the corridor or the region receives a disproportionate share of the financial burden of the capital and operating and maintenance costs relative to the benefits received. No financial equity considerations are raised by the project, either in terms of the source of subsidy or the level of fare payments required of passengers.

Environmental Equity

Expanded transit services, whether TSM, BRT, or LRT, provide environmental benefits to the region. By increasing transit use and attracting trips from automobiles, the alternatives reduce emissions and energy, although these reductions are a relatively small proportion of the regional totals. The daily reduction in automobile trips ranges from 11,400 to 20,500 for the Build alternatives. BRT and LRT are expected to better support the local plans for economic development and community development benefits to residents of the region and the corridor compared to the TSM Alternative because of the higher number of riders attracted to the service. While there are some adverse proximity effects for those communities who back on to the Georgetown Branch right-of-way purchased over two decades ago for, and designated in the *Georgetown Branch Master Plan* for a joint transitway and trail facility, and along some of the street-running surface alignments, these communities would have access to the improved transit services provided and would be among the beneficiaries of the mobility and accessibility improvements.

Trade Offs

An overall assessment of how well each of the alternatives helps attain local goals and objectives involves consideration of all areas and measures described above. Moreover, it is dependent upon the relative priorities and value judgments placed on the individual items. Thus, while the AA/DEIS report provides the necessary quantitative and qualitative assessments needed as a basis for decision making, the final evaluation of performance of alternatives with respect to the attainment of local goals and objectives requires a collective analysis of the trade-offs involved in comparing relative advantages and disadvantages of the alternatives in each of the subject areas analyzed.

Transportation services and facilities connect people with their jobs, education, recreation, and other personal needs. Transportation services and facilities are essential for developing and sustaining the economy; they shape and affect our communities and environment. Thus investments in transportation, particularly public investment in higher performing transit improvements, are intended to achieve objectives well beyond just mobility. Economic

development, community development, and environmental objectives and measures must be considered along with mobility objectives when evaluating the high capacity transit alternatives for the corridor.

The No Build Alternative would leave unaddressed the mobility problems for the circumferential travel patterns to, from, and between the major activity centers, the residential communities, and the regional transit system network in the corridor, especially the Metrorail system. It leaves unaddressed the economic and community development, environmental, and master plan goals established for communities and jurisdictions along the corridor.

The TSM would address these problems to a limited degree leaving much of the needs and goals unaddressed or under-addressed.

All the BRT and LRT Alternatives address the mobility problems and needs and the economic and community development, environmental, and master plan goals established for communities and jurisdictions in the corridor. These goals would be maximized by the higher investment in LRT Alternatives and particularly the High Investment LRT Alternative. The capital cost and annual operating subsidy required for this alternative are substantial and would require a large commitment of federal, state, and local financial resources. A substantial amount of the benefits would be achieved by the Medium Investment LRT Alternative but at a lower cost. The BRT Alternatives would require lower capital and annual operating subsidy investments and commitment of financial resources, but would provide lower achievements of the mobility and other needs and objectives.

An issue generating a high degree of interest in Chevy Chase and the Columbia County Club area is the use of the Georgetown Branch railroad right-of-way along which the Interim Georgetown Branch Trail is located. The re-introduction of rail operations with the LRT Alternatives, or introduction of Medium or High Investment BRT, in conjunction with the construction of the permanent Capital Crescent Trail segment, as called for in the Montgomery County Master Plan for several decades, would remove essentially all of the trees within narrower portions of the right-of-way. The trees and vegetation on the properties abutting the right-of-way would be expected to remain and maintain much of the tree cover and visual character. The design features and character of the transitway and trail are intended to minimize the impacts. The No Build and TSM Alternatives would not use the Georgetown Branch right-of-way but as described above would not address the needs and objectives for the project. The only Build Alternative that would avoid the use of this segment of the Georgetown Branch right-of-way west of Jones Mills Road would be Low Investment BRT. In addition to shifting any concerns of operating the transit service to other communities along Jones Bridge Road, this alternative also would be the least effective Build Alternative in addressing the corridor needs and project objectives. Further, the Jones Bridge Road alignment is not in the County master plans and as such, was never subject to the public review required under the master planning process. The Low Investment BRT runs adjacent to the National Naval Medical Center, which will be the site of growth in employment and activity from the BRAC program, nonetheless, all other Build alternatives provide comparable, if not better transit access and service in combination with existing Metrorail and bus services. The Build alternatives that use the full extent of the Georgetown Branch right-of-way are not only faster, but would also provide more reliable service.

Tunneling and other types of underground construction of the alignments require a much higher expenditure of capital funds than surface or even aerial alignments. The Build alternatives would employ tunnel sections where they would be required for topographic conditions or where they would provide operating speed improvements over surface alignments. The trade off of the higher capital cost and increased mobility benefits was discussed earlier. Tunnels or underground construction, suggested for the Georgetown Branch right-of-way as an impact avoidance measure, provide no operating speed or mobility benefits while substantially increasing the capital cost; thereby lessening the cost-effectiveness of the alternative in the FTA New Starts rating. Similar suggestions for longer tunnels in response to community concerns, specifically along Wayne Avenue, would have similar effects as the tunnel segment provides little improvement in the mobility benefits relative to the higher capital cost.

Notwithstanding the effectiveness and cost-effectiveness of the Build alternatives, the availability of state and federal capital funds may limit what could ultimately be spent for the implementation of a project in the corridor. Considerations of other transit projects in the state, other transportation, and other funding priorities, and availability of federal funds may establish an upper limit on what could be invested in the corridor. The response could involve: selecting an alternative that falls within the funding availability, implementing only a portion of an alternative (minimal operating segment or MOS) either as the full extent of the project or as an initial phase of the project with other phases implemented later; or deferring the implementation of a project until funding for the locally preferred alternative is available.

Where we are in the planning process

The AA/DEIS is part of the Environmental Planning Process outlined in the following graphic. Ultimately, the State of Maryland will decide which alternative (No Build, TSM or one of the Build alternatives) is the Locally Preferred Alternative for the corridor. If a Build

Alternative is chosen, MTA would prepare a Final Environmental Impact Statement (FEIS), documenting the decision, and then ultimately a Record of Decision would be issued by the FTA allowing Final Design, right-of-way acquisition, and construction activities to proceed.

Next Steps

MDOT and MTA will select a Locally Preferred Alternative from among the current alternatives and options. The State of Maryland will consider information contained in the AA/DEIS, available funding, and public comments received during the AA/DEIS comment period in making their decision. When the preferred alternative is chosen, operational and construction effects will be further evaluated and included in the Final EIS.

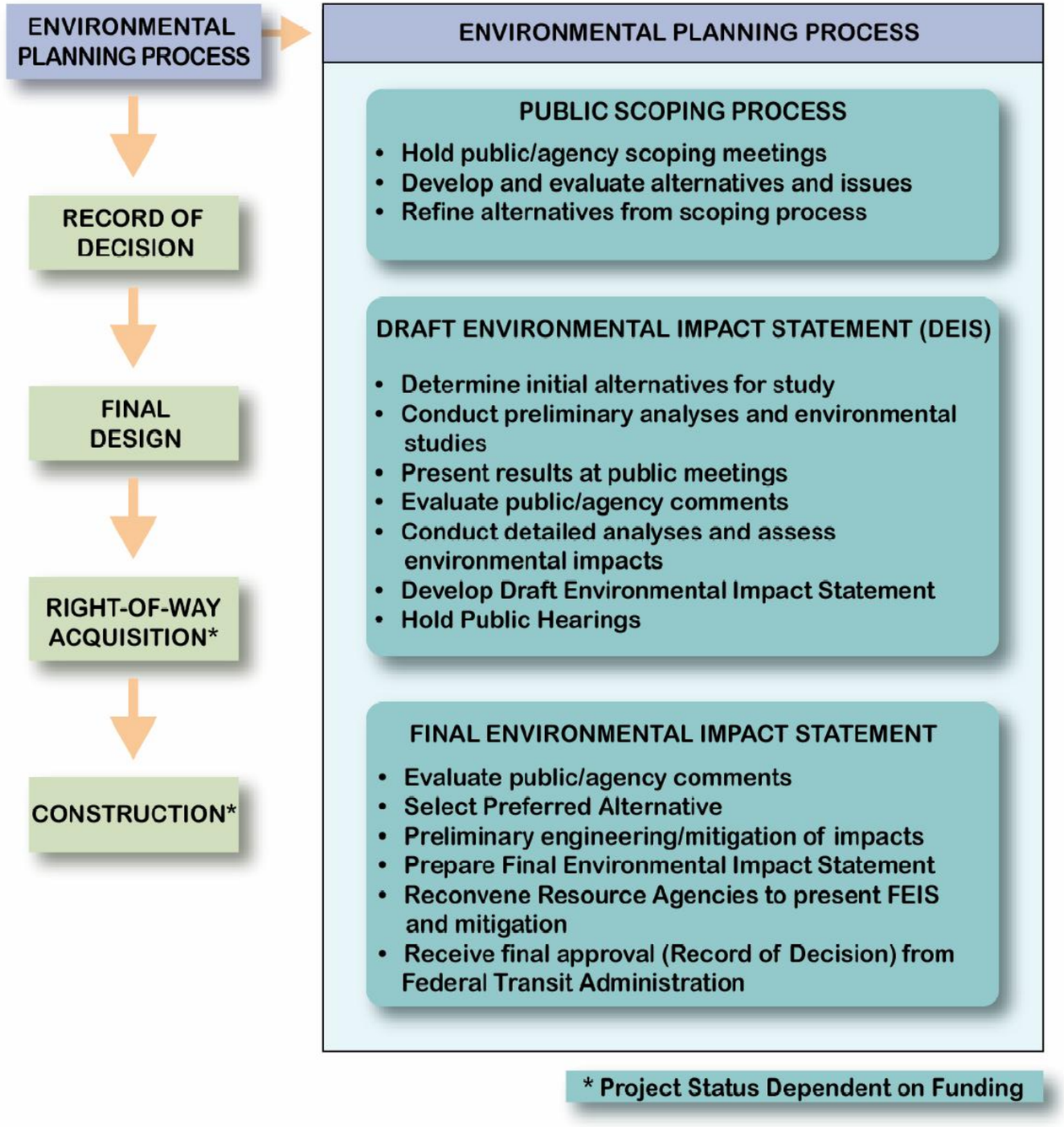
The information presented in the AA/DEIS will be made available to the public and agencies for review and comment in the August-September 2008 time frame. A series of public hearings will be held at several locations in the Purple Line corridor to provide an opportunity for the public to submit comments on the document and input to the decision on selecting the Locally Preferred Alternative. In response to a request from the public, an extended 90-day circulation and comment period will be provided.

The State of Maryland will review the public and agency comments, and in consultation with the counties, local jurisdictions, elected officials, and involved transit providers, make a decision on a Locally Preferred Alternative. The decision will identify the transit mode and the level of investment, recognizing the No Build and TSM Alternatives are among the choices for the decision makers. Based on comments and review of the technical results, some refinement of the

selected alternative may involve decisions on any design options and incorporation of certain features from other alternatives. Considerations by the State of Maryland with regard to the Corridor Cities Transitway Corridor and the Baltimore Red Line Corridor, as well as other transportation priorities, may affect the phasing and timing of the Locally Preferred Alternative implementation.

In spring 2009, the MTA expects to submit a New Starts Criteria package for the Purple Line Locally Preferred Alternative to the FTA. Once FTA rates the project, and assuming a recommended rating, MTA will submit a Request to Initiate Preliminary Engineering to the FTA.

During Preliminary Engineering, the Locally Preferred Alternative will be further developed, technical and community and natural environmental impact assessments and mitigation measures further refined, and an implementation plan developed. During Preliminary Engineering, the FEIS will be prepared and circulated for comments. The FEIS will include responses to comments submitted on the AA/DEIS, as well as commitments on mitigation and required resource permits. Following the review of FEIS comments, FTA would issue a Record of Decision completing the federal environmental review process.



Chapter 1
Purpose and Need

Chapter 1. Purpose and Need

The Maryland Transit Administration (MTA) has undertaken an Alternatives Analysis and Draft Environmental Impact Statement (AA/DEIS) to study a range of alternative means for addressing mobility and accessibility issues in the corridor between Bethesda and New Carrollton in Montgomery and Prince George's Counties, Maryland, just north of the District of Columbia boundary. The study is considering a range of alternatives to improve east-west transit mobility in the 16-mile corridor that connects several major activity centers at the Metrorail stations: Bethesda, Silver Spring (both on the Red Line), College Park (Green Line), and New Carrollton (Orange Line) as well as the Takoma Park/Langley Park area and the University of Maryland. This transit project is intended to provide enhanced transportation choices and improved accessibility for people in the corridor; to support local plans for economic development, transit oriented development and community revitalization; to improve system efficiency and intermodal connectivity; and to help address the region's air quality issues.

This study examines several different alternatives, from modest investments in shared-use roadways, to major investments in a dedicated guideway, grade-separated where necessary, to determine which mix of improvements achieves the greatest mobility and related benefits, balanced against costs and impacts on communities and the environment. Two modes, light rail transit (LRT) and bus rapid transit (BRT), were identified during the public scoping process as the modes most appropriate for this project. This chapter of the AA/DEIS identifies the need for transportation improvements in the corridor and provides an overview of existing transportation facilities and services, transit markets in the corridor, existing transportation problems, and states the goals and objectives used to evaluate the proposed alternatives.

Improvements to the transportation system in the corridor would address the following transportation challenges:

- Increasing congestion on the roadway system
- Slow and unreliable transit travel times on this congested roadway system
- Limited travel mode options for east-west travel
- Degraded mobility and accessibility between major activity centers and residential areas
- Degraded transit accessibility to the larger metropolitan region due to inferior connections to radial Metrorail lines and to other rail and bus services

For example, a peak period trip by car between the University of Maryland campus and Silver Spring that takes 24 minutes today will take 37 minutes in 2030. A peak period automobile trip from Silver Spring to Bethesda will increase from 14 minutes today to 21 minutes in 2030 while that same trip by bus will increase from 17 minutes to 32 minutes; and a trip by rail will require a 35-minute trip on the Red Line through downtown Washington, DC.

Changing land uses in the Washington metropolitan area have resulted in more suburb-to-suburb travel, while the existing transit system is oriented toward radial travel in and out of downtown Washington, DC. Transit trips within the corridor are expected to increase by 43 percent by 2030.

The only transit service available for east-west travel is bus service, which is slow and unreliable because it operates on congested roadways in the corridor between major activity centers. A bus trip between New Carrollton to Silver Spring requires a transfer at College Park Metro Station from the WMATA J4 route to the J6 route while the Montgomery County Ride-On and Prince George's County TheBus services along the corridor terminate at the county line, requiring a transfer in Takoma/Langley Park. There is no efficient, reliable, and high capacity transit for east-west travel in the corridor. Providing more direct transit service between the major activity centers and communities in the two counties would provide travelers with a more efficient and convenient trip. The Purple Line would serve transit patrons whose journey is solely east-west in the corridor, as well as those who want to access the existing north-south Metrorail system. The Purple Line would also provide a direct link to the Brunswick, Camden, and Penn Lines of the Maryland MARC commuter rail system and to Amtrak's Northeast Corridor service at New Carrollton.

The corridor has a sizeable population that relies heavily on transit; and contains some of the busiest transit routes and transfer areas in the Washington metropolitan area. Many communities in the corridor have a high percentage of households without a vehicle. Continued growth projections of population and employment in the corridor indicate that there will be a growing need for transit improvements in the corridor. The increasingly congested east-west roadway system does not have adequate capacity to accommodate the existing average daily travel demand, and congestion on the existing routes is projected to worsen as traffic continues to grow through 2030. Many communities in the Purple Line corridor are built out; therefore new road construction or road widening to increase capacity and reduce congestion are not feasible.

Metrorail provides north-south rapid transit in parts of the corridor, but transit users who are not within walking distance of these services must drive or use slow and unreliable buses that often operate over circuitous routes to access Metro stations. Faster and more reliable connections along the east-west Purple Line corridor to the existing radial rail lines (Metrorail and MARC trains), bus routes, and activity centers within the corridor would improve mobility and accessibility. Enhancing the connectivity of the transit system would improve transit efficiencies, making the system more attractive to a larger number of people.

In addition, a need exists to address poor air quality in the region. Changes to the existing transportation infrastructure will help in attaining Federal air quality standards by attracting automobile trips to less polluting transit service,

Purpose and Need for Project

The purpose of the proposed project is to provide faster, more direct and more reliable east-west transit service in the Purple Line corridor, which would connect the four major activity centers, including the Metrorail services located there, to each other, and with the communities located between them. The existing and expected future roadway congestion in the corridor will have an increasingly detrimental effect on the travel times and reliability of east-west bus transit services in the corridor. The proposed Purple Line corridor transit improvements are intended to improve travel times and reliability by providing more direct services that will operate on dedicated and exclusive lanes and guideways.

reducing automobile vehicle miles traveled and combustion engine emissions.

The transit improvements being considered for the Purple Line corridor are intended to address these challenges by providing shorter and more reliable transit travel times by enabling faster transit vehicle operating speeds through the provision of more priority, dedicated and exclusive operating conditions. The degree that the alternatives address these intentions can be measured by reduced transit travel times, time savings for users, improved operating speeds, and attraction of more riders to transit.

This document presents the information developed for the AA/DEIS to support local decision-making regarding the need for transit investments in the Purple Line corridor, as well as the type and scale of that investment.

This study is being conducted to meet the requirements of the National Environmental Policy Act of 1969 (NEPA). This act requires consideration of impacts to the natural and human environment of any federal action. NEPA requires a systematic interdisciplinary approach and requires certain statements, including the following:

- The environmental impacts of the action
- Adverse impacts that cannot be avoided
- Alternatives to the proposed action
- Consequences of the proposed action

In addition, consultation with federal agencies and public participation in the planning process are required.

This document is also an Alternatives Analysis (AA) prepared for the Federal Transit Administration (FTA) in accordance with Congressional mandates. The requirements of the AA process are intended to allow for an objective, efficient, and fully informed evaluation and rating of the transit projects seeking funding under the Federal New Starts process.

1.1. Project History

The origins of an east-west transit route in this area can be traced to the former railroad freight line spur called the Georgetown Branch. This 11-mile railroad line owned by B & O Railroad carried coal and building supplies on a weekly train from Bethesda to Georgetown until service was discontinued in 1985. The National Park Service purchased the railroad right-of-way between Georgetown and the Washington, DC boundary, and the Montgomery County Council purchased the right-of-way from the Washington, DC boundary to the CSX Metropolitan Branch right-of-way under the National Trails Systems Act in 1988. The Maryland-National Capital Park and Planning Commission (M-NCPPC) was given jurisdiction from the Washington, DC line to Bethesda, and the Department of Public Works and Transportation was given jurisdiction over the right-of-way from Bethesda to Silver Spring for the future development of a transitway, either light rail or bus, in addition to the Capital Crescent Trail.

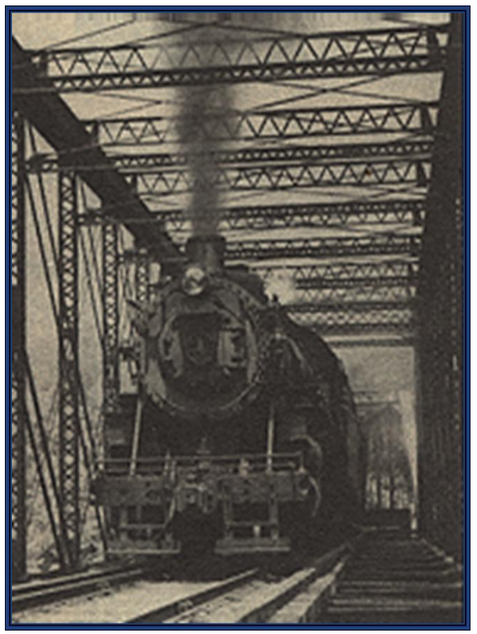
The *Georgetown Branch Master Plan Amendment* (November 1986) designated the right-of-way between Bethesda and the Metropolitan Branch as a public right-of-way intended to be used for public purposes, such as conservation, recreation, transportation, and utilities.

In 1986, Montgomery County issued a report entitled the *East-West Transitway Feasibility Study*. This study was followed by the County's *Georgetown Branch Corridor Study* in 1989. Both studies evaluated the use of the Georgetown Branch right-of-way as a transitway.

In October 1988, the Maryland Department of Transportation (MDOT) released a *Study of the Appropriateness and Applicability of Light Rail Transit in Maryland*, which determined that seven of the 24 study areas identified were potentially appropriate for LRT. Of the seven study areas, the Georgetown Branch project, from Bethesda to Silver Spring, was ranked as the most cost-effective.

In 1989, MDOT identified $70 million of projected revenues within the six-year Consolidated Transportation Program (CTP) to be earmarked for the project. In winter 1990/ spring 1991, the State legislature approved the FY 1990-1995 CTP which included $70 million for the project – $1.9 million in FY 1991 and $3.8 million in FY 1992 for engineering and design. In May 1990, the MTA conducted further evaluations and cost estimates for the project. The results are summarized in the *Georgetown Branch Trolley/Trail Conceptual Report* (1990). In 1991, the project was suspended because the costs estimated in the 1990 study exceeded the amount allocated by the State.

Freight Train on Georgetown Branch Trestle Bridge over Rock Creek ca. 1910



A report by the Metropolitan Washington Council of Governments (MWCOG), *The Potential for Circumferential Transit in the Washington Region* (August 1993), assessed the potential of circumferential rail, bus, and high occupancy vehicle (HOV) facilities to provide viable links between suburban residential, commercial, and employment centers to maintain mobility in the Washington metropolitan area. The report concluded that the pattern of suburban land activity inherent in 20-year forecasts would not provide a viable basis for circumferential rail transit along the Capital Beltway or along outer suburban corridors. It also identified the Georgetown Branch connection between the Bethesda and Silver Spring Metro Stations as the most promising circumferential rail linkage inside the Capital Beltway.

The MTA completed the *Georgetown Branch Transitway/Trail Major Investment Study/Draft Environmental Impact Statement (MIS/DEIS)* in 1996, which considered both a combined light rail and hiker/biker trail and a busway and trail to connect Bethesda to Silver Spring. The document was available for public review and comment on May 24, 1996, and a public hearing was held on June 26, 1996. A Final Environmental Impact Statement was never produced for this study.

In November 1998 the Montgomery County Council endorsed light rail and a trail as the Preferred Alternative for the Georgetown Branch, Bethesda to Silver Spring segment.

The incorporation of the Georgetown Branch into a larger Purple Line, envisioned to eventually circle Washington, DC, began with

the *Capital Beltway/Purple Line Study* initiated by the Maryland State Highway Administration (SHA) and the MTA in 1996. The study shifted from an original focus on HOV solutions on the Capital Beltway to multimodal transportation improvements in the Capital Beltway corridor. This included the consideration of several heavy rail and light rail lines that extended along the 42-mile segment of the Capital Beltway in Maryland, from the American Legion Bridge to the Woodrow Wilson Bridge. The corridors included routes located along, outside, inside, and crossing the Capital Beltway. In all, six different corridors using either heavy rail (Metrorail) or light rail technology were considered. Of the *Capital Beltway/Purple Line Study* corridors, Options P2 (heavy rail) and P6 (light rail) included the Bethesda to New Carrollton segment. Completed in 2002, the *Capital Beltway/Purple Line Study* recommended the "Inner Purple Line" (inside the Beltway) as the priority transit corridor. The term "Purple Line" was adopted to be consistent with the Washington Metropolitan Area Transit Authority's (WMATA) practice of naming Metrorail routes by color.

In response to this study, a second project was initiated, the *Purple Line East, Silver Spring to New Carrollton*. This project was initiated by WMATA. Simultaneously the MTA began the preparation of a Supplemental DEIS for the Georgetown Branch. Subsequently the Georgetown Branch became known as the ''western'' segment of the Purple Line; the *Purple Line West, Bethesda to Silver Spring*.

In October 2001, Governor Parris Glendening directed Transportation Secretary John D. Porcari to make planning, funding, and building the 16-mile P6 light rail project the State's top transit priority.

In March 2003, under the direction of the new governor, Robert Ehrlich, the two projects were combined and renamed the Bi-County Transitway Project. Transportation Secretary Robert Flanagan announced plans to explore another mode, bus rapid transit (BRT). The BRT alternatives would use dedicated lanes on existing roadways to allow buses to move faster than automobile traffic.

New Starts

The Federal Transit Administration's (FTA) Section 5309 New Starts program is the Federal government's primary financial resource for supporting locally-planned, implemented, and operated transit "guideway" capital investments. From heavy to light rail, from commuter rail to bus rapid transit systems, the New Starts program has helped to make possible nearly 100 new or extended transit fixed guideway systems across the country. If a Build alternative for the Purple Line is selected federal funding will be necessary to finance the project.

As provided in the New Starts regulation (49 CFR part 611), New Starts funding requires the submission of certain specific information to the FTA to support a request to initiate preliminary engineering, which is normally done in conjunction with the NEPA process.

In September 2003, the FTA and the MTA published a Notice of Intent (NOI) that they would be preparing an Environmental Impact Statement (EIS) in accordance to the National Environmental Policy Act (NEPA) of 1969, as amended, on the proposed Bi-County Transitway Project. This NOI for the Bi-County Transitway Project extended the previous projects limits beyond Silver Spring to New Carrollton. In addition, MTA announced that it intended to seek New Starts funding for the project.

The MTA initiated a joint AA/DEIS following FTA's Major Capital Projects policies and procedures.

Public and agency scoping for the Bi-County Transitway Project was held in September 2003. The scoping process began with public notification of four public meetings. The four meetings were held in the Takoma/Langley area, Silver Spring, Bethesda, and College Park on four evenings in mid-September 2003. Over 350 comments were submitted through the scoping process. Comments covered a broad range of topics and stated approval or disapproval of both general alignment issues and specific routes. Mode and alignment were the categories that received the most comments.

Scoping

Scoping is the first step in the NEPA planning process and provides agencies and the public opportunity to comment on the range of proposed actions, alternatives, and impacts to be discussed in the DEIS.

In January 2007, at the direction of newly elected Governor Martin O'Malley, the project returned to its former name, the Purple Line.

1.2. Corridor Setting

The Purple Line corridor is located north and northeast of Washington, DC, with a majority of the alignment within one to three miles inside the circumferential I-95/I-495 Capital Beltway (see Figure 1-1).

1.2.1. Existing Land Use

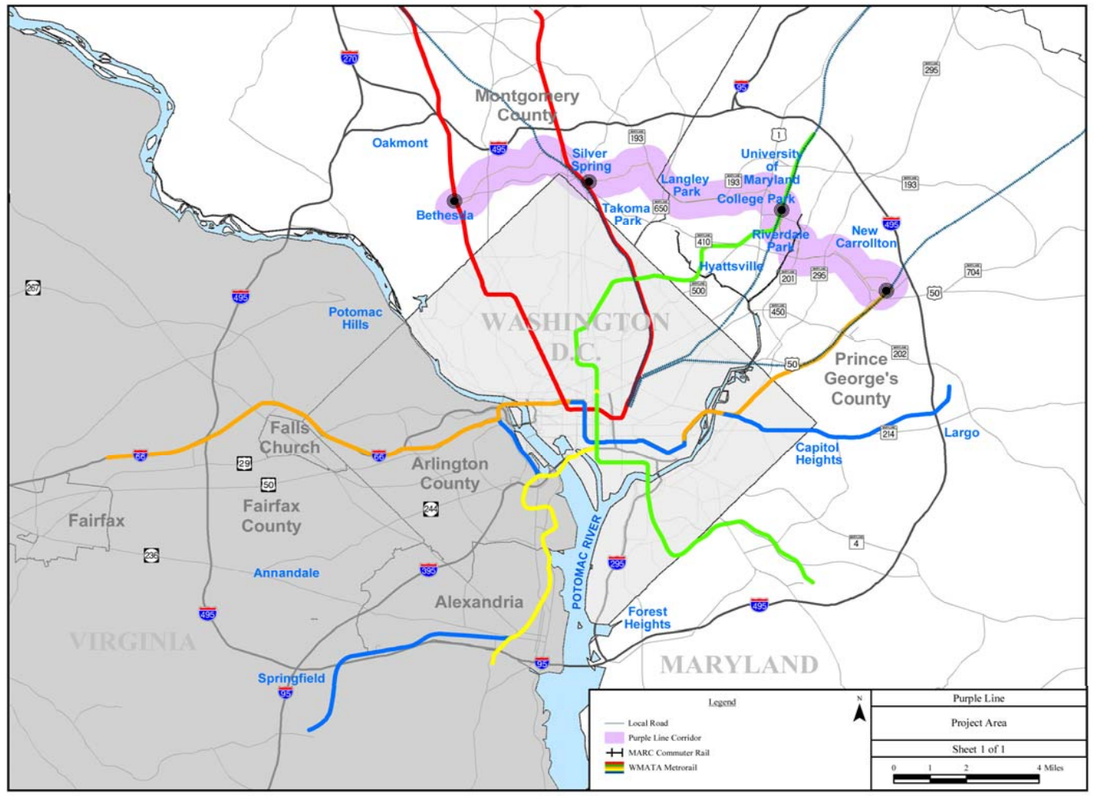
This portion of the Washington metropolitan area experienced rapid development following World War II and now contains mature neighborhoods with the majority of housing constructed prior to 1960. The corridor includes established inner-ring communities that contain pockets of higher-density development in Bethesda, Silver Spring, Takoma Park, Langley Park, and College Park. Many commercial areas are primarily retail, and the activity centers are older in design and function. These activity centers have substantial deficiencies in access, parking, and pedestrian circulation.

Land use in the Montgomery County portion of the corridor is primarily residential, with large concentrations of commercial development in Bethesda and Silver Spring. The communities in the corridor include a mix of housing types and densities. Most of these areas have, in part or in whole, plans that emphasize transit oriented mixed-use land uses in areas adjacent to transit stations.

Bethesda

The Bethesda central business district is characterized by high-density mixed uses. Montgomery County planned for and encouraged the dense development of Bethesda around the Metro station prior to construction of the Red Line in the area, applying zoning with densities and floor area ratios for high-rise development. The central business district has developed as planned and continues to grow; particularly to the south and west. Indicative of this development is the decision to move forward with the creation of a new south entrance to the Bethesda Metro Station. The need for this entrance was anticipated when the station was initially built, but deferred until the station usage required it.

Figure 1-1: Project Area



East of the Bethesda central business district, single-family and some multi-family residences predominate in the corridor, with some small-scale commercial development.

Silver Spring

Downtown Silver Spring has experienced extensive redevelopment in the last 10 years. Major projects are being developed with nearly $1 billion in public and private investment in renovations and new construction.

This development, centered on the multimodal Silver Spring Metro Station, is urban in character with a mix of commercial, residential, and entertainment uses. As part of a public/private venture at the existing Silver Spring Metro Station, the MTA, Montgomery County, and WMATA are building a new expanded transit center with adjacent transit oriented development. The Transit Center will serve Metrorail, MARC commuter rail, Amtrak, and WMATA, Montgomery County Ride On, and intercity buses. The Silver Spring Transit Center is also designed to accommodate a station for the Purple Line. The County has leveraged this exceptional accessibility by successfully encouraging dense development in the area with zoning and density bonuses around the transit center.

The eastern Silver Spring, Long Branch, and Takoma Park communities are characterized by established residential neighborhoods that are compactly developed, containing a mix of single-family and multi-family dwellings.

Langley Park

At the border of Montgomery and Prince George's Counties, Langley Park is characterized by garden apartments, older automobile-oriented commercial areas, and diverse ethnic populations who rely heavily on transit. The area along University Boulevard, known as Maryland's International Corridor, is a major shopping and entertainment center, particularly for the many immigrant communities in the area. Despite very low levels of automobile ownership among residents, this area is very congested, with many pedestrians crossing busy roadways to access transit and shopping. The intersection of University Boulevard and New Hampshire Avenue, site of the future Takoma/Langley Transit Center, is one of the busiest bus transfer points in the region.

Land use along the remaining Prince George's County portion of the corridor, from Langley Park to New Carrollton, except for the University of Maryland, is primarily comprised of residential uses, with several large parks and some commercial areas. Housing types and densities in this area are largely single-family dwellings interspersed with low-rise apartment complexes.

University of Maryland/College Park

The University of Maryland, located in College Park, is the largest employer and trip generator in Prince George's County. The University currently has 36,000 students and more than 12,000 employees. The University hotel and conference center, and new and existing sports and performing arts facilities are additional sources of activity.

Two other University of Maryland-associated developments will be markets for the Purple Line: the East Campus Redevelopment Initiative and the M-Square Research Park. East Campus is a mixed-use project on the east side of US 1, south of Paint Branch Parkway. This development will be a mix of residential and commercial uses. Goals of the project include

Plaza on Ellsworth Drive, Downtown Silver Spring

establishing a connection between the University, Metro, and the Research Park.

M-Square, in the River Road area, adjacent to the existing College Park/University of Maryland MARC and Metrorail stations, will include state-of-the-art research, laboratory, and incubator facilities dedicated to the advancement of technology, computer science, mathematics, engineering, biotechnology, and physical and life sciences. It is currently under construction and is expected to employ more than 6,500 people at completion.

WMATA is currently working with private developers, planning joint development at the College Park Metro station. This mixed-use transit oriented development may be an additional source of ridership for the Purple Line.

Riverdale Park

The Riverdale Park area is primarily single-family residential with some older automobile-oriented commercial development. In early 2008 Prince George's County planners and local officials began coordinating on the potential for redevelopment of the west side of Kenilworth Avenue, and at the intersection of Kenilworth Avenue and East West Highway. The MTA is working with the county to integrate the Purple Line and its Riverdale Park station into these plans.

New Carrollton

Annapolis Road is a retail corridor characterized by strip commercial development. Although the residential development near the New Carrollton Metro Station is primarily single-family, several large institutional trip generators, including the Internal Revenue Service, are located there. Local plans for the New Carrollton Metro Station are for high-density transit oriented development. WMATA is pursuing mixed-use joint development for the property it owns on both sides of the station. Also proposed is an extensive redevelopment of two privately owned sites east of the existing rail tracks. This development includes over 2,400 residential units, and over 900,000 square feet of retail, and office uses in buildings as high as 40 stories. A separate 43-storey municipal building is proposed.

1.2.2. Existing Transit Service

Rail transit, including the WMATA Metrorail Red, Green, and Orange Lines, MTA's MARC service, and Amtrak operate in the corridor. These rail lines are oriented to downtown Washington, DC, and do not provide east-west travel. Bus service in the corridor is provided by all three jurisdictions: WMATA Metrobus, Montgomery County Ride On, and Prince George's County TheBus. The current public transit options that accommodate east-west trips are bus routes traveling in mixed traffic. As a result, the Purple Line corridor is faced with increasing travel times and unreliable transit service; this limits accessibility and negatively affects the corridor's economy and residents' quality of life, particularly for those without a private automobile.

Despite this situation, the Purple Line corridor has a proven high transit patronage. Metrorail, Metrobus, and Ride On have more than 48,000 weekday boardings in Silver Spring, making this one of the busiest transit stations in the region. Twenty-two Metrobus and four Ride On routes serve the Silver Spring Transit Center. The bus stop at the Takoma/Langley Crossroads is Ride On's busiest transit hub not connected to a Metrorail station. Each weekday, more than 15,000 passengers get on and off buses at the Takoma/Langley Crossroads on four Metrobus, three Ride On, and two TheBus routes. The three busiest bus routes in the Ride On system run between Silver Spring and Langley Park. The second highest ridership in the Metrobus service in Maryland is on the WMATA C2 route, which runs along University Boulevard in the Purple Line corridor. The WMATA F4 and F6, which serve the area between Silver Spring and the New Carrollton Metro Station, have the highest ridership of any line in Prince George's County and experienced growth of 5.5 percent between May 2006 and May 2007. New Carrollton is second only to Union Station in the Washington metropolitan area as a major multimodal transportation hub with Metrorail, Amtrak, MARC, Greyhound intercity bus, and both

regional (Metrobus) and county (TheBus) bus service available. Daily boardings and alightings for Metrorail at New Carrollton currently average 3,600, and 3,700, respectively. Metrobus serves the station with 20 routes, and TheBus serves it with four routes.

The University of Maryland operates a shuttle bus service for its students, faculty, and staff who make two million trips per year. Three of the 18 UM Shuttle routes operate in the Purple Line corridor serving such major activity centers and destinations as the Silver Spring Metro Station, the College Park Metro Station, and M-Square Research Park. UM Shuttle 111, Silver Spring Metro, duplicates much of the proposed Purple Line alignment, operating on University Boulevard, Piney Branch Road, and Wayne Avenue; and UM Shuttle 104 provides serve between the University of Maryland campus and the College Park Metro Station.

More than 75 bus routes operate in the Purple Line corridor; of these, only 12 provide east-west service.

Existing bus service operating east-west in the corridor consist of several overlapping or interconnecting routes as shown in Figure 1-2. WMATA operates the regional routes, those that are inter-jurisdictional, while each of the counties operate the local routes. WMATA J1, J2, and J3, with a combined headway of six minutes (a bus every six minutes in the peak period), serve the long-haul trips between Montgomery Mall, Medical Center, Bethesda, and Silver Spring, with 6500 daily weekday passenger trips. Ride On 15 is the primary service between Silver Spring and Langley Park with four-minute headways in the peak period and nearly 7,200 daily passenger trips. East of Langley Park, WMATA C2 and C4 carry most of the passengers, with C4 diverting south to Prince George's Plaza and C2 continuing through the University of Maryland campus, then traveling north on US 1 to the Greenbelt Metro Station. WMATA F6 also serves a portion of the corridor, connecting Prince George's Plaza Metro Station with the University of Maryland Campus, the College Park Metro Station, and the New Carrollton Metro Station. See Table 1-1.

The Silver Spring Metro Station is a major transportation hub, with nearly 120 buses per hour in the peak periods. The majority of these routes terminate in Silver Spring. Approximately 10,000 bus-to-bus transfers take place daily, in addition to the large number of bus-to-rail transfers. WMATA J4 is the only east-west route that does not terminate at Silver Spring (thus avoiding a transfer time penalty and ridership loss) east and west of Silver Spring.

East-west transit service in the Purple Line corridor is primarily oriented toward short trips focused on major activity centers. In other words, the transit network is a feeder/distributor-based operation that is inadequate for corridor travel, especially longer trips through major activity centers. As such, the network is choppy, disjointed, and operated by three essentially unrelated service providers. There is a lack of coordination and the route structure is not suited for present day mobility needs.

Figure 1-2: Existing East West Transit Service

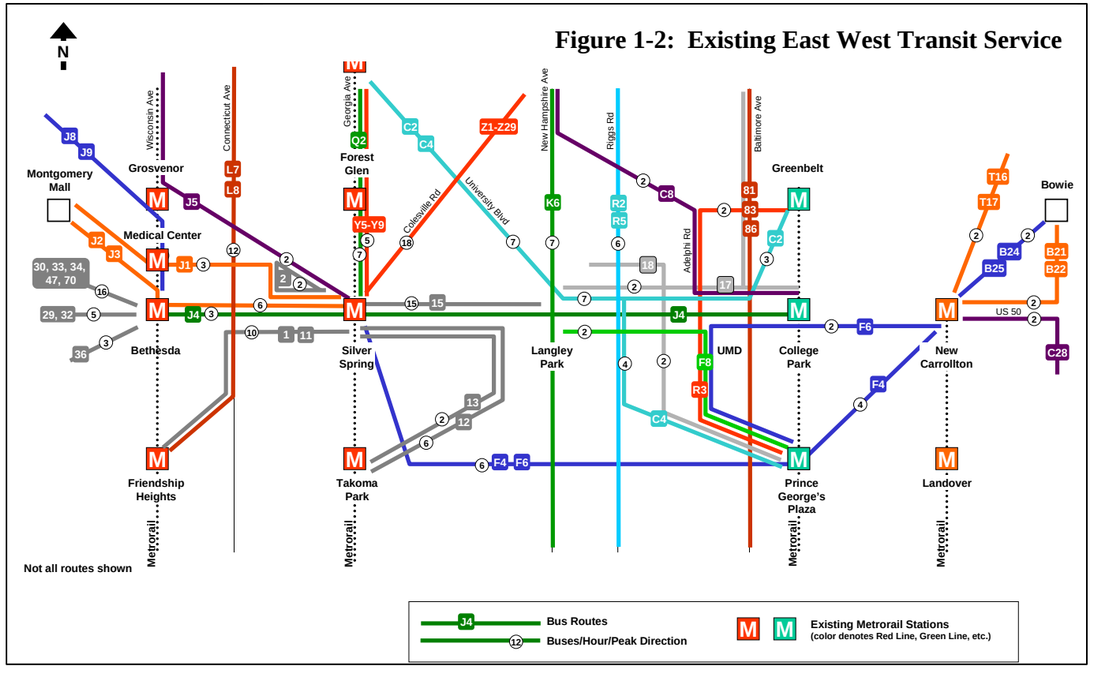


Table 1-1: Existing East-West Bus Service

Route	Terminal and Intermediate Points	Early Morning	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday	Average Daily Riders
J1	Montgomery Mall-Medical Center-Silver Spring Metro	--	20	--	20	--	--	--	790
J2	Montgomery Mall-Bethesda-Silver Spring Metro	20	17	20	24	15	20	25	4,750
J3	Montgomery Mall-Bethesda-Silver Spring Metro	--	17	--	24	--	--	--	1,020
J4	Bethesda Metro-Silver Spring-College Park Metro	--	20	--	20	--	--	--	1,025
C2	Wheaton Metro-Greenbelt Metro	--	22	30	16	--	30	--	5,180
C4	Twinbrook Metro-Prince George's Plaza Metro	10	22	30	16	30	30	16	7,780
F4	Silver Spring – New Carrollton	12	12	40	15	--	30	60	4,640
F6	Silver Spring – New Carrollton	--	20	40	30	--	--	--	3,090
Ride On 15	Silver Spring Metro-Langley Park	15	4	12	4	30	12	15	7,200
TheBus 17	Langley Park-UM-College Park Metro	45	45	45	45	--	--	--	80
UM Shuttle 111	UM – Silver Spring Metro	--	35	75	45	30	--	--	500
UM Shuttle 104	UM – College Park Metro	8	8	12	8	20	20	20	2,500

Although the Purple Line corridor contains an increasingly substantial population that relies heavily on transit to reach employment and activity centers, new transit services in this east-west corridor have been limited to bus service on local roads that are subject to the same roadway congestion as automobile traffic. To date, there has been no investment in fixed guideway systems or in new highways to facilitate east-west travel and enhance links between the employment and residential centers along circumferential transportation routes in the corridor. The built up character of the corridor precludes the construction or widening of the existing roadways.

1.2.3. Transit Service Markets

The diversity of land uses, markets, and socio-economic characteristics in the Purple Line corridor mean that both origins and destinations are present and, therefore, a significant amount of travel occurs entirely within the corridor. The major activity centers in the corridor include business and retail destinations, educational institutions, and sports and entertainment facilities. Another function of the Purple Line would be to provide access to other transit modes and services.

The Purple Line would serve at least five important travel markets in the corridor:

1. From an origin in one of the "wedges" (a wedge is one of the areas between the four major radial, rail corridors) to a Metrorail station to gain access to Metrorail and to travel to a destination outside the corridor, such as downtown Washington, DC. This is the conventional suburb-to-downtown work market trip during which the rider would use the Purple Line as a feeder service to the Metro to travel downtown or elsewhere.
2. From one Metrorail station in the corridor to another. The Purple Line would eliminate the need to travel into downtown Washington, DC and back out again on Metrorail to reach a destination in the Purple Line corridor. The Purple Line would provide a connector service between four Metrorail lines.
3. From an origin outside the corridor, such as Shady Grove or the District of Columbia, to a destination within the corridor either at an activity center or in a wedge. This is the converse of the first two types of market and serves as a distributor function to the Metro.
4. Between a wedge and one of the activity centers in the corridor. These activity centers include Bethesda, Silver Spring, Takoma Park/Langley Park, University of Maryland, College Park, Riverdale Park, and New Carrollton. This market is for a single-seat trip from an origin in one of the wedges to one of the major activity centers in the corridor without the need to use Metrorail.
5. From wedge to wedge. This is a market that would be served exclusively by either local bus service or the Purple Line. It would not involve transfer to Metrorail. Wedge-to-wedge travel may be entirely within the corridor and could be a one-seat ride or it could entail transfer to a local bus for travel from an origin or to a destination outside the corridor.

Each of these markets would be served by the Purple Line, albeit in different ways and for different purposes. Each would dictate different planning strategies and operating paradigms. The first three markets are feeder, connector, or distributor services to Metrorail. For the last two markets, the destination is within or near the Purple Line corridor and does not require use of Metrorail. Feeder or distributor local bus service could supplement the Purple Line to complete the trip in any of these markets.

The Purple Line would directly connect several major activity centers to the MARC Penn Line and to Amtrak's Northeast Corridor via the New Carrollton station, the MARC Brunswick Line at Silver Spring, and the MARC Camden Line at College Park. Connections to these facilities substantially expand the market reach of the Purple Line by providing access to areas not served by Metrorail, including Frederick, Howard, and Anne Arundel Counties, BWI Airport, the Baltimore central business district, Western Maryland, and major metropolitan areas in the northeast.

Figure 1-3 shows the Washington metropolitan region defined as a set of districts to enable a discussion of the current travel patterns and markets. Districts are identified around the major activity centers of Bethesda, Silver Spring, College Park, and New Carrollton in the Purple Line corridor. Three additional districts are used to describe the "wedge" areas in between the major activity center, Connecticut Avenue/ Lyttonsville, Takoma Park/Langley Park, and Riverdale Park. These seven districts constitute the Purple Line corridor. Other districts are used to define major sections of Washington, DC, and travel market areas around the Metrorail lines (both branches of the Red Line, the Green Line, and the Orange Line) running north and northeast of the corridor. The rest of the region is defined by larger districts for the remainder of Maryland and the areas of Virginia.

Table 1-2 shows the daily transit trips among these districts for the year 2000 for all trips purposes with the origin of the trips listed along the vertical side of the table and the destinations of the trips along the top of the table. The Purple Line corridor has approximately 169,000 daily transit trips that have one or both ends of the trip in the corridor. This represents some 9.5 percent of the transit trips for the Washington region. Some 44,000 of these transit trips have both ends of the trip within the Purple Line corridor while 60,000 transit trips are between the corridor and some part of Washington, DC. A large number of the remaining trips are associated with districts to the north or northeast of the Purple Line corridor along the Metrorail lines. The majority of the trips in the corridor (134,000) are associated with the major activity centers, while the other 35,000 are associated with the wedge districts. Of the trips associated with the major activity centers, only 9,000 are from one major activity center to another. For the wedge district trips, 8,400 are associated with the major activity centers with 15,400 associated with the Washington, DC districts.

What this information shows is that while there is quite a bit of existing transit travel within the corridor, that corridor trips associated with areas outside the corridor are greater, i.e., corridor trips associated with Washington, DC and area north along the Metrorail Red, Green and Orange lines that run through the major activity centers, especially up toward Shady Grove, the Rockville area and the Glenmont area. While the major activity center districts account for most of the trips, a substantial number of trips are associated with the wedge districts, those areas not presently served by Metrorail and dependent on street-running bus service operating in congested mixed traffic, are linked with either one of the major activity centers or areas reachable via the Metrorail system, especially Washington, DC

By the year 2030, daily transit trips are forecast to grow by 52 percent or from 953,000 to 2,711,000. Transit trips associated with the corridor grow by 65,000 or 38 percent to 234,000, while trips within the corridor grow by 18,000 or 43 percent to 62,000 trips. While the general pattern and distribution of these transit trips would be similar to current trips, the level of growth is substantial, increasing the severity and the magnitude of the mobility needs of corridor travelers.

1.3. Need for Transportation Improvements

The Washington metropolitan area has experienced continual population growth, both in employment and population. The existing transportation facilities, especially inside the Capital Beltway (I-95/I-495) often do not meet this increased demand. This is especially true of east-west travel.

Figure 1-3: Purple Line Corridor Travel Districts

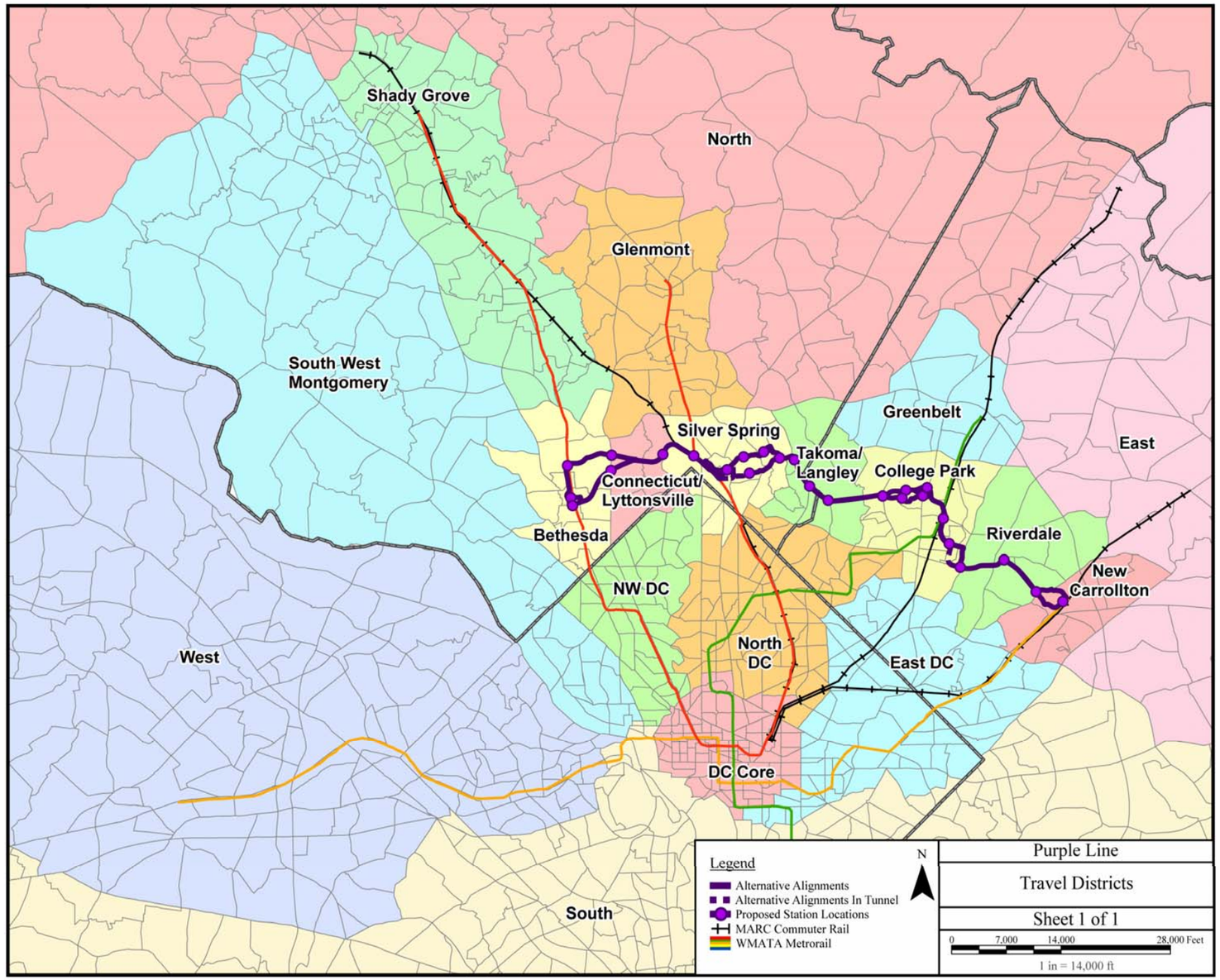


Table 1-2: Daily Transit Trips, Origins, and Destinations by District, 2000

	Bethesda	Connecticut - Lyttonsville	Silver Spring	Takoma - Langley Park	College Park	Riverdale Park	New Carrollton	Corridor TOTAL	Shady Grove	Glenmont	Greenbelt	Northwest DC	North DC	East DC	DC Core	Southwest Montgomery County	North	East	South	West	Total
Bethesda	3,484	358	1,720	583	182	115	64	**6,507**	4,573	1,978	110	1,532	1,352	514	3,719	2,923	3,081	301	1,533	745	28,870
Connecticut - Lyttonsville	358	14	232	54	15	4	2	**680**	184	161	7	112	99	20	412	114	123	8	41	24	1,985
Silver Spring	1,720	232	2,378	1,175	403	125	73	**6,108**	1,325	2,334	196	739	2,526	610	4,797	732	2,164	268	994	284	23,075
Takoma -Langley Park	583	54	1,175	573	819	87	70	**3,362**	473	503	317	293	1,209	373	2,861	260	644	135	419	152	11,002
College Park	182	15	403	819	679	406	152	**2,656**	147	229	554	110	1,062	821	1,560	88	657	611	569	69	9,133
Riverdale Park	115	4	125	87	406	191	317	**1,246**	73	30	176	69	326	547	1,391	45	84	268	367	95	4,718
New Carrollton	64	2	73	70	152	317	466	**1,145**	43	32	83	36	279	869	1,332	27	109	584	1,112	53	5,702
Corridor TOTAL	**6,507**	**680**	**6,108**	**3,362**	**2,656**	**1,246**	**1,145**	**21,703**	**6,819**	**5,267**	**1,443**	**2,891**	**6,854**	**3,755**	**16,073**	**4,187**	**6,862**	**2,175**	**5,035**	**1,422**	**84,486**
Shady Grove	4,573	184	1,325	473	147	73	43	**6,819**	10,136	2,924	82	708	743	268	3,696	3,874	5,731	185	798	497	36,461
Glenmont	1,978	161	2,334	503	229	30	32	**5,267**	2,924	3,469	99	447	770	181	4,104	876	1,972	67	439	218	20,832
Greenbelt	110	7	196	317	554	176	83	**1,443**	82	99	297	66	415	328	959	47	377	402	267	46	4,828
Northwest DC	1,532	112	739	293	110	69	36	**2,891**	708	447	66	3,502	3,535	946	13,580	1,806	421	102	2,855	1,029	31,889
North DC	1,352	99	2,526	1,209	1,062	326	279	**6,854**	743	770	415	3,535	8,390	3,338	25,368	1,225	882	497	5,224	1,023	58,263
East DC	514	20	610	373	821	547	869	**3,755**	268	181	328	946	3,338	4,571	15,589	401	344	757	6,458	611	37,548
DC Core	3,719	412	4,797	2,861	1,560	1,391	1,332	**16,073**	3,696	4,104	959	13,580	25,368	15,589	39,853	7,879	7,282	4,457	66,819	20,315	225,975
Southwest Montgomery County	2,923	114	732	260	88	45	27	**4,187**	3,874	876	47	1,806	1,225	401	7,879	2,865	2,282	94	1,472	751	27,757
North	3,081	123	2,164	644	657	84	109	**6,862**	5,731	1,972	377	421	882	344	7,282	2,282	11,649	690	905	522	39,918
East	301	8	268	135	611	268	584	**2,175**	185	67	402	102	497	757	4,457	94	690	1,146	1,150	205	11,927
South	1,533	41	994	419	569	367	1,112	**5,035**	798	439	267	2,855	5,224	6,458	66,819	1,472	905	1,150	101,432	24,816	217,668
West	745	24	284	152	69	95	53	**1,422**	497	218	46	1,029	1,023	611	20,315	751	522	205	24,816	39,945	91,399
TOTAL	**28,870**	**1,985**	**23,075**	**11,002**	**9,133**	**4,718**	**5,702**	**84,486**	**36,461**	**20,832**	**4,828**	**31,889**	**58,263**	**37,548**	**225,975**	**27,757**	**39,918**	**11,927**	**217,668**	**91,399**	**888,951**

Note: Shaded cells are districts in the Purple Line corridor

As noted earlier, the *Capital Beltway/Purple Line Study* examined the growing levels of demand in the Washington metropolitan area and the possibilities for increasing capacity on roadways. The conclusion was that roadway capacity alone would not address the problem sufficiently, and that transit was part of the solution. The Inner Purple Line, inside the Capital Beltway between Bethesda and New Carrollton, was identified as the top priority transit project.

The corridor contains a major (and increasing) commuting population that travels to and from Washington, DC, Montgomery and Prince George's Counties, and other parts of the region. Convenient, efficient east-west transit service is not available in the corridor. The need for improved transit services is heightened as it becomes more difficult to commute from locations with housing choices to jobs that are dispersed along the corridor and throughout the region. New employment opportunities are no longer clustered exclusively in downtown Washington, DC, and a number of Federal functions, such as the Food and Drug Administration and Internal Revenue Service, that were traditionally located in the District, have relocated to the Purple Line corridor.

A number of basic elements contribute to the transportation problem:

- The movement of employment centers out of downtown Washington, DC
- Presence of multiple markets for east-west travel
- A large population that relies on transit
- A transit system that is oriented toward radial travel into and out of Washington, DC
- Projected employment and population increases
- Changing travel patterns

These elements of the transportation problem are the root causes of the more directly perceived transportation problems:

- A highly congested roadway system
- An east-west transit system that is unreliable, slow, and discontinuous

The transit improvements being considered for the Purple Line corridor, as described in more detail in Chapter 2, are intended to address these challenges by providing shorter and more reliable east-west transit travel times by enabling faster transit vehicle operating speeds through the provision of more priority, dedicated and exclusive operating conditions. The degree that the alternatives address these intentions can be measured by reduced transit travel times, time saving for users, improved operating speeds, and attraction of more riders to transit.

1.3.1. Changing Travel Patterns

Historically, downtown Washington, DC, has been the location of most jobs, while people lived outside the center. As the suburbs grew, more people commuted longer distances into the center and the radial Metrorail system was built to serve this travel. However, jobs are increasingly relocating to suburban areas resulting in suburb-to-suburb travel patterns. In the Washington metropolitan area, as is true throughout the United States, suburb-to-suburb travel has increased dramatically in the past 20 years.

Currently, 20 percent of the trips in the region involve travel to and from jobs. These commuting trips are generally twice as long as non-work trips and tend to occur at the same time of day and to go to the same places each day. Although commuter travel, occurring as it does at the same time every day, creates the high levels of congestion that often trigger the demand for improved transportation facilities, more than 80 percent of travel is not to and from work. When people are not commuting, they are traveling for a variety of reasons – picking up children at school, going to movies, eating at restaurants, or shopping for groceries. The locations of these activities are often more spread out than job sites, and this dispersion affects the types of transportation services and facilities needed. As the urban core of Washington, DC, continues to be the center of economic and tourist activities attracting visitors from across the globe, investment in public transit projects is imperative to the region's economic vitality. Twenty-five years from now the core will continue to have the greatest concentration of jobs in the region; however, increasingly people will be traveling from one suburb to another. By 2030 the majority of trips will be suburb-to-suburb travel.

Most redevelopment of suburban areas in the Purple Line corridor has been mixed use, adding non-residential uses to the corridor. The creation of new jobs and destinations for a variety of activities means new travel patterns in the corridor. Table 1-3 shows the number of jobs at key employment centers in the corridor.

Table 1-3: Existing Employment at Major Centers

Employment Center	Number of Jobs
Bethesda CBD[1]	34,833
Silver Spring CBD[1]	29,741
University of Maryland[2]	12,000
New Carrollton[1]	8,705

[1] Source: Round 7.0 Forecast, MWCOG
[2] Source: University of Maryland

Implications of the Defense Base Realignment and Closure (BRAC) Process

When the BRAC Commission decided to close or combine aging bases nationwide, the State of Maryland was a primary recipient of employment from bases closing in other areas. Fort Meade, Aberdeen Proving Ground, Fort Dietrich, Andrews Air Force Base, and the National Naval Medical Center are expected to grow by 20,000 employees when BRAC is fully implemented in 2011. The shift of 1,750 jobs from Walter Reed Army Medical Center in northeast Washington, DC to National Naval Medical Center (NNMC) is expected to change commuting patterns in the near term for the positions that are being transferred. The actions noted in BRAC identify a changing picture of employment and visitor trips to the new combined medical center being planned on the site of the NNMC in Bethesda with the overall addition of 2,200 to 2,500 jobs and an increase in hospital visitors as noted in the NNMC DEIS.

The Purple Line AA/DEIS used MWCOG Round 7.0 2030 land use forecasts for employment, households and population in the analysis. The assumed growth for these items was based on normal growth assumptions for each zone in the region. A concern was raised about the implications of this change on the long-term assumptions for this project. However, given the scale of the expected growth excluding the BRAC changes, analysis of the changing trip patterns for the 2030 horizon year indicates that the effects of BRAC will be negligible.

The Bethesda area exists today and in the future as a major employment and population center exclusive of the BRAC changes. Combined employment around the Medical Center Metro Station is expected to grow by over 6,000 jobs to 2030 and population is expected to grow by approximately 700 in that time. The Bethesda CBD is expected to grow by 5,000 jobs and show a population increase of over 12,000 residences in that same period. The BRAC changes, while large, are a small percentage of the expected 72,000 jobs in the entire Bethesda CBD - Medical Center area in 2030.

Therefore, given the access afforded by Purple Line alternatives along the Master Plan alignment and connecting the Metrorail Red Line to the Medical Center Station, the impacts of BRAC on travel in the Bethesda area are notable more for the additional delays expected on area roadways than for the potential contributions to Purple Line ridership.

1.3.2. Access for Transit-Reliant Populations

Dense clusters of population along the corridor rely heavily on transit for mobility and accessibility. A study of U.S. Census 2000 data reveals that many communities in the corridor have a high percentage of households without a vehicle (see Table 1-4).

Bethesda, Woodside, Silver Spring, Long Branch, Takoma Park, Langley Park, Lewisdale, Riverdale Park/Heights, and New Carrollton have rates ranging from 15 percent to 25 percent, considerably higher than the Montgomery and Prince George's County rates of 7 percent and 10 percent, respectively, and the State of Maryland rate of 11 percent. Some of these communities have low rates of vehicle ownership because of the mobility provided by the existing transit, particularly Metrorail, rather than because of personal financial constraints. This is true of most of the Montgomery County communities, notably Bethesda and Chevy Chase.

Table 1-4: Percent of Households without a Vehicle

Community	Percent of Households without a Vehicle
Bethesda	18%
Chevy Chase	11%
Rock Creek Forest / Lyttonsville / Rosemary Hills	13%
Woodside	16%
Silver Spring	24%
East Silver Spring	12%
Long Branch	18%
Takoma Park	16%
Langley Park	25%
Lewisdale	15%
Adelphi	9%
College Park	10%
Riverdale Park / Heights	15%
Glenridge / Beacon Heights	14%
New Carrollton	18%
West Lanham Hills	9%
Montgomery County	7%
Prince George's County	10%
State of Maryland	11%

Source: US Census 2000, Summary File 3
Note: Shaded rows are higher than the corresponding county percentage.

1.3.3. Population and Employment Growth

MWCOG has projected continued increases in employment and population in the Maryland suburbs by 2030. The inner suburbs, which include Montgomery and Prince George's Counties, will experience the greatest increase in congestion, and will continue to have the most congestion in the region.

Table 1-5 provides growth projections for three major activity centers in the transitway corridor.

These increases will put additional pressure on the already congested roadways. No quality service is available for the east-west travel market that wants or needs an alternative to traveling by automobile. Moreover, this demand is projected to grow as 2030 population, employment, and the resulting traffic increases become a reality.

1.3.4. Traffic Conditions

With the anticipated population and employment growth, the existing Purple Line corridor is facing numerous transportation challenges as a result of limited infrastructure for east-west travel. The primary east-west travel routes, consisting of the Capital Beltway, East West Highway (MD 410), and University Boulevard (MD 193) are heavily congested during peak periods and on weekends, and are unable to accommodate increases in demand for east-west travel. Many major intersections, such as University Boulevard and New Hampshire Avenue, already experience failing levels of service (LOS) in both morning and evening peak periods. Table 1-6 shows the average daily traffic volumes and levels of service for a number of these primary east-west travel routes within the corridor. The high traffic volumes are above the capacity of the existing east-west roadways and intersections, and this is reflected in the failing levels of service.

Because the corridor is already built-up, expanding highway capacity and building new roadways to address the inadequate capacity of existing roadways is difficult at best. The projected increases in employment and population will only make the situation worse. The impacts of these traffic conditions on street-running transit service could be great. WMATA reports that their actual running times on the J4 route between Bethesda and College Park can range upwards of 50 percent higher than the typical times that are shown in published timetables. Not only does this obviously inconvenience riders, it also means that it is very difficult to operate the network of services reliably and in a manner that optimizes interconnectivity and mobility.

1.3.5. Transit System Efficiency and Connectivity

Although several modal choices (automobiles on highways, commuter rail, and bus service) and intermodal opportunities (park-and-ride lots and Metrorail) are available in the Purple Line corridor, current transit options are limited in many areas because the only modes serving east-

Table 1-5: Household and Employment Forecasts

Location	Households			Employment		
	2000	2030	% Change	2000	2030	% Change
Bethesda CBD	6,720	12,938	93%	34,833	41,567	20%
Silver Spring CBD	5,646	14,016	148%	29,741	34,626	16%
New Carrollton	854	1,430	67%	8,705	15,339	76%

Source: Metropolitan Washington Regional Activity Centers and Clusters, Round 7.0 Forecasts , Metropolitan Washington Council of Governments 2007.

west markets are automobiles and regular buses, both severely impacted by the existing traffic congestion and making access to the radial routes difficult and inconvenient.

The corridor has a lack of direct routes between major activity centers. As a result, a need exists for faster, more reliable and more direct transit service, with greater capacity, and improved system connectivity to address the mobility and accessibility deficiencies of the study corridor.

Currently, transit riders can travel between Bethesda, Silver Spring, College Park, and New Carrollton on an existing Metrorail line. However, travel between these stations requires either riding into Washington, DC and then, in most cases, transferring onto a different radial line or traveling circumferentially on one or more of the many slow, often discontinuous, indirect bus routes.

Bus services between Bethesda and New Carrollton are limited and require transfers between existing bus routes. This necessity further slows travel times and decreases travel convenience and dependability. Montgomery County's Ride On bus routes from Bethesda run only as far east as the Takoma/Langley area. In addition, Prince George's County's service, TheBus, only runs between the Takoma/Langley area and College Park. Currently, no direct bus service exists from Bethesda to New Carrollton or from Takoma/Langley area to New Carrollton. Metrobus routes bridge the gap in service between Montgomery and Prince George's Counties by operating several routes through the Takoma/Langley area. One of the busiest transit centers in the corridor is Prince George's Plaza, which is not along the Purple Line alignment but is, nonetheless, an important destination for Metrobus and TheBus routes in the eastern portion of the Purple Line corridor.

Bus utilization is constrained by trip times. In most cases, bus travel times are slower than individual automobile trips, since buses typically make frequent stops. These slow speeds do not provide an incentive for those with automobiles to use transit. Every transfer between routes adds substantially to travel times, inconveniencing transit patrons and discouraging transit use. A faster, more reliable, and more direct transit service with greater capacity would address the mobility and access deficiencies of the Purple Line corridor.

Table 1-7 illustrates the existing travel times for various modes in the segments between Bethesda and New Carrollton. The travel times are based on the published weekday schedules. However, the congested roadways mean that actual travel times, at least for those using bus services, are likely slower. Many of these trips require transfers from one bus route to another.

Table 1-7: Current Scheduled Transit Travel Times for Segments

Location	Rail[1]		Bus[2]	
	Distance (miles)	Time (min.)[3]	Distance (miles)	Time (min.)[3]
Bethesda – Silver Spring	16.5	35	4.4	17
Bethesda – Takoma/Langley	N/A	N/A	7.7	30
Bethesda – UM Campus Center	N/A	N/A	10.2	39
Bethesda – New Carrollton	19.2	50	16.9	87
Silver Spring – Takoma/Langley	N/A	N/A	3.3	16
Silver Spring – UM Campus Center	N/A	N/A	5.8	24
Silver Spring – New Carrollton	19.4	51	12.5	60
Takoma/Langley – College Park	N/A	N/A	4.0	15
Takoma/Langley – New Carrollton	N/A	N/A	9.2	44
College Park – New Carrollton	21.6	55	5.2	17

[1] METRO Rail times are based on peak-hour travel (7:00-7:30 AM and 4:00-4:30 PM)
[2] Bus times are the quickest time for all possible bus service and routes, including WMATA's F4, F6, J2, J4; Ride On's 15, 16, 17, 18 and TheBus 17
[3] Times were calculated from published weekday schedules as of September 2007

Table 1-6: Traffic Levels, 2005 and 2030

Location	2005		2030 Projections	
	AADT[1]	LOS AM/PM	AADT	LOS AM/PM
Capital Beltway, Wisconsin Avenue (MD 355) to Georgia Avenue (MD 97)[2]	227,575	F/F	285,000	F/F
Capital Beltway, Georgia Avenue (MD 97) to I-95[2]	215,150	F/F	269,000	F/F
Capital Beltway, I-95 to US 502	241,425	E/E	302,000	F/F
Jones Bridge Road at Connecticut Avenue (MD 185)[3]	22,300	F/F	27,900	F/F
University Boulevard (MD 193) at New Hampshire Avenue (MD 650)[2]	49,825	F/F	62,300	F/F
East West Highway (MD 410) at Connecticut Avenue (MD 185)[2]	29,375	F/F	36,700	F/F
East West Highway (MD 410) at 16th Street (MD 390)[2]	32,475	F/F	40,600	F/F
East West Highway (MD 410) at Baltimore Avenue (US 1)[2]	25,925	F/F	32,400	F/F
East West Highway (MD 410) at Kenilworth Avenue (MD 201)[2]	40,950	F/F	51,200	F/F
Annapolis Road (MD 450) at Veterans Parkway (MD 410)[2]	37,925	F/F	47,400	F/F

Notes:
[1] Average Annual Daily Traffic
[2] Source: MD State Highway Administration, 2005
[3] Source: Purple Line Traffic Studies, 2005

1.4. Project Goals and Objectives

The goals and objectives of the Purple Line are based on the transportation challenges and needs identified for the corridor. The goals and objectives discussed below and listed in Table 1-8 were used to develop and evaluate the project alternatives.

1.4.1. Improve Mobility and Accessibility

Improving transit mobility and accessibility in the corridor is the most fundamental goal of the Purple Line. It will support economic viability and accommodate the projected employment and residential growth in the corridor. System connectivity is a major aspect of increasing mobility and improving accessibility.

As discussed earlier, despite the fact that suburb-to-suburb travel is increasing in the Washington metropolitan area, provisions have not been made for improved circumferential connections to the radial network. No major corridor transit or roadway initiatives are planned through 2030 for the Purple Line corridor. Although making circumferential transit in the suburbs work is

very challenging, the Purple Line corridor is a logical opportunity for such service. Historically, lower densities in the suburbs and the lack of a single focus for trip origins and destinations make it necessary to plan circumferential service carefully. A major element in this planning is the recognition that circumferential routes not only play key roles feeding and distributing passengers in the radial corridors, but also provide intra- and inter-community service within the corridor itself.

Increased system connectivity is essential to maximizing the benefits of a transit system and to fully optimize past and future investments in transit service and infrastructure. Where transit users are able to access a wide variety of destinations in different directions, ridership will be higher as the system is able to meet the needs of a wider range of riders. Effective connectivity (i.e., that which is convenient and easy for riders to make use of), extends the service reach of the service area. Travel choices and mobility opportunities in the corridor would drastically increase and become more convenient, improving the efficiency of transit and aiding those who cannot commute via automobile.

Reducing travel time and providing a consistent, predictable travel time are key elements in encouraging people to use transit and in measuring the overall merit of a project.

1.4.2. Enhance Environmental Quality

As we, as a society, develop a better understanding of the impacts of our actions on the human and natural environments, as well as the scope and duration of these impacts, projects such as these should be designed to demonstrate stewardship of our resources and communities. Transit in and of itself is beneficial to the natural environment because it can provide transportation to large numbers of people with fewer environmental impacts than private automobiles.

Nonetheless, all transportation projects have the potential to cause adverse effects to the human and natural environments. The developed character of the area means that the human environment is of particular significance, but the natural environment has also been carefully considered. This study identifies transit improvements that avoid or minimize effects to these and other resources to the extent possible, characterize any effects that appear to be unavoidable, and describes actions that could be taken to mitigate adverse effects as part of the implementation of alternatives.

Indirect effects may include the development of nearby areas, traffic associated with new

Table 1-8: Project Goals and Objectives

Goal	Objectives
Increase Mobility and Improve Accessibility	• Improve transit linkages to existing and planned economic development areas in the corridor • Improve access to jobs in corridor • Increase employers' access to labor pool • Reduce transit travel times between major activity centers in the corridor • Improve mobility for transit-dependent households • Improve intermodal connections • Construct a permanent multi-use trail from Bethesda to Silver Spring if the Georgetown Branch right-of-way is used for the transit alignment • Link radial Metrorail lines for better transit system connectivity
Improve Transit Operations Efficiencies	• Improve overall dependability and reliability of transit system in the corridor Increase regional transit usage • Improve feeder services and access facilities at existing and proposed stations appropriate for surrounding land use
Enhance Environmental Quality	• Minimize and mitigate impacts to the natural and human environment in the corridor • Provide a safe and attractive transit service that is compatible with local community character • Support local, regional, and state policies and adopted Master Plans
Optimize Public Investment	• Demonstrate that the overall benefits of the transit improvements warrant their capital and operating costs • Support Maryland's Smart Growth strategy of supporting existing communities by targeting resources to support development in areas where infrastructure exists • Improve east-west transit services
Support Local Plans for Economic and Community Development	• Support of local and state land use plan for transit oriented development at existing and proposed stations • Support development and revitalization of major activity centers such as Bethesda, Silver Spring, Takoma Park, Langley Park, College Park, Riverdale Park, and New Carrollton • Improve access to jobs in the region • Enhance connections within communities in the corridor and to the entire region
Contribute to Attainment of Regional Air Quality Standards	• Reduce automobile usage • Support and facilitate energy conservation

development, and the environmental effects of the development. The area is largely already developed, and much of it is targeted for revitalization and redevelopment. The study considers the indirect effects and cumulative effects of the alternatives, consistency with state and local land use policies, and potential implications for the region. Alternatives were developed in an environmentally sensitive manner.

1.4.3. Support Local Plans for Economic and Community Development

A number of areas in the corridor, such as Takoma Park, Langley Park, College Park, Riverdale Park, and New Carrollton, are pursuing economic revitalization. Some of these areas are already the focus of economic incentive programs by local governments, and a substantial improvement in the quality of transit services has been identified by local planning agencies as a key factor in these efforts.

Land Use Plans and Policies

The master plans in Montgomery County for areas including Bethesda, Silver Spring, and Takoma Park encourage future development projects that offer integration with existing and planned transportation projects. Maryland Smart Growth strategies likewise support these initiatives. These transit oriented development policies have encouraged continuing infill and redevelopment in areas in the corridor. Moreover, the Purple Line, along the Georgetown Branch alignment between Bethesda and Silver Spring, is a key element of several area master plans in Montgomery County.

In Prince George's County, the *Approved General Plan,* specifically supports implementation of the circumferential transit alignment (referred to as the Purple Line) and recommends capitalizing on the economic development and community revitalization potential of such an alignment. The *General Plan* recommends transit oriented, mixed-use development for its "Developed Tier" residential and commercial areas. The Developed Tier consists of all the area inside the Capital Beltway, including Langley Park, the City of College Park (including the University of Maryland), Riverdale Park, and New Carrollton. University Boulevard is designated a "Corridor" where more intensive development is encouraged. Plans for areas along the Purple Line corridor offer support for future transit planning by making it a requirement that any project considered for development in the respective areas have access to, or integration with, existing or planned transportation projects. County master plans in the area support transit oriented mixed-use development.

The Purple Line also supports principles of Smart Growth that have been adopted by the State of Maryland. These principles cover a range of topics but two particularly relevant to the Purple Line are as follows:

- Provide a variety of transportation options
- Strengthen and direct development to existing communities

One of the core objectives of Smart Growth is to encourage new development in currently built-up areas as this will take full advantage of the existing infrastructure, including transportation. Opportunities for infill and transit oriented development in close proximity to Purple Line stations are being explored as an economic redevelopment benefit of this project. This will complement current redevelopment activities occurring in and around Bethesda, Silver Spring, Takoma Park, Langley Park, College Park, Riverdale Park, and New Carrollton.

1.4.4. Optimize Public Investment

Transit investments are huge capital and operating expenditures, and it is clearly fiscally sensible to maximize the value of those investments by creating a system that will attract more riders, support local planning policies, and allow development that will take advantage of the benefits that transit can provide. Key elements in encouraging people to use transit and in measuring the overall merit of a project are reducing travel time and providing a consistent and predictable travel time.

Expansion and Revitalization of Businesses

Transit accessibility and mobility can play an important role in the growth and development of communities and in the quality of life for local residents and transit patrons. This is particularly true for low income residents who do not own a car.

> The interrelationship between transit expansion and economic development is well documented, particularly in the Washington, DC region. Transit improvements help to generate employment and economic growth. Based on research conducted by the Center for Transportation Excellence, the Washington region's Metrorail system has generated nearly $15 billion in surrounding private development. WMATA projects that this amount is likely to double to as much as $30 billion in the next 10 to 12 years. Between 1980 and 1990, 40 percent of the region's retail and office space was built within walking distance of a Metrorail station.

The Purple Line will support economic development in the region. Several areas through which the Purple Line would pass have been designated by local planning authorities as redevelopment zones and are areas where improved transit connectivity would benefit residents and businesses. The Purple Line would support these revitalization activities, which build upon transit oriented development and design principles.

The Bethesda central business district is densely developed and plays a key role in local and regional economic markets. At least five approved developments are within one-quarter mile of the Purple Line's proposed terminal station in downtown Bethesda. The majority of these planned development sites, including office, retail, and residential development, are currently under construction.

The expanded regional transit center in Silver Spring will support the revitalization and economic development of its compact central business district. Frequent and reliable transit service is important for providing access and support for the mixed-use development currently under construction in the Silver Spring central business district.

The Long Branch community has been designated a Priority Place by the State of Maryland. Priority Places receive heightened assistance from state agencies, which direct a variety of resources, regulatory help, and technical expertise their way.

Long Branch-Takoma Park has been named an Enterprise Zone Focus Area. One of only three such focus areas in the State of Maryland, the designation provides property owners with:

- Tax Credits
- "Green Tape" expedited review of Development Projects
- Grants for Exterior Renovations
- Loans for Small Businesses
- Economic Development Fund

Proposed Takoma/Langley Park Transit Center

- Exemptions From Washington Suburban Sanitary Commission Systems Development Charge
- Small Business Loans

The Flower Avenue Shopping Center, at the intersection of Piney Branch Road and Flower Avenue, has been identified as the initial focus of redevelopment in the area. This small commercial area has been designated as a Commercial Revitalization Overlay Zone (CROZ). The *Takoma Park Master Plan* (2000) recommends improvements to enhance the pedestrian environment and the implementation of traffic-calming measures. The plan favors preservation of the neighborhood and encourages community-oriented retail with an emphasis on transit and trail connections. Currently, this community has a dense multifamily housing with poor transit accessibility.

The Purple Line would provide access to Takoma/Langley Crossroads located at the intersection of University Boulevard and New Hampshire Avenue, which is also part of a CROZ. The *Takoma Park Master Plan* (2000) envisions a major community commercial center and transit terminal in this area. Currently the Takoma/Langley area is the subject of a sector plan being prepared jointly by Montgomery and Prince George's Counties. The goal of the Takoma/Langley Park Crossroads Sector Plan is to enhance the unique character of this diverse multi-cultural community and implement both counties' existing General Plan recommendations. The emphasis will be on promoting mixed-use, pedestrian friendly, and transit–oriented development opportunities around Purple Line stations. The Takoma/Langley Crossroads Development Authority is leading an effort to improve conditions of the existing strip commercial centers at this site.

The MTA is designing and engineering the Takoma/Langley Transit Center, which will accommodate the 11 bus routes that currently serve the area, and to consolidate them at one central location, thereby making transfers easy and safe. This Transit Center will be a station on the Purple Line. The extremely low rates of vehicle ownership in this area and the high percentage of people living below the poverty line (18 percent) mean that the addition of the Purple Line will provide a much needed benefit to local residents, improving access to such important destinations as employment, health care, and educational resources.

In College Park and Riverdale Park, a special Transportation District Overlay Zone (TDOZ) has been established just south of the College Park Airport and adjacent to the College Park/University of Maryland Metrorail Station. Prince George's County specifies that the purpose of a TDOZ is to ensure that the development of land near Metrorail stations maximizes transit ridership and takes advantage of the development opportunities associated with mass transit projects. Elements such as building heights, set backs, and density are tailored to promote pedestrian destinations within reach of transit stations, resulting in an increased return on the transit system investment and improving local tax revenues. The plan includes mixed-use development with office, retail, residential, and light industrial components.

The *Annapolis Road Corridor Planning Study* (2004) recommends a development strategy for Annapolis Road between the Capital Beltway and the Baltimore Washington Parkway. The report identifies this area as a focus of redevelopment efforts by Prince George's County. The recommendations include supporting transit oriented development at the New Carrollton Metro Station; improving the transportation infrastructure, particularly for pedestrians; and designing the Purple Line to ensure good linkages between the Purple Line and the Annapolis Road corridor.

The New Carrollton TDOZ includes an area extending west approximately one-half mile from the New Carrollton Metrorail Station. The envisioned economic effects are the same as those outlined in the College Park TDOZ. Large office building complexes, such as the Federal Internal Revenue Service, have been built on portions of the TDOZ closest to the Metrorail station. The recently completed New Carrollton District Development Plan (2008) presents a development vision of the station area that would leverage the benefits of the transit station. Both WMATA and Prince George's County support mixed-used development within a quarter mile of stations. WMATA is forestalling development on its property adjacent to the Metro station pending selection of the Locally Preferred Alignment to ensure that the development does not conflict with the right-of-way needs of the Purple Line.

1.4.5. Long-Term Attainment of Regional Clean Air Goals

Poor air quality affects the health of residents and affects the availability of federal funding assistance for transportation investments throughout the region.

The Clean Air Act of 1970 and its Amendments (1977 and 1990) (CAA) and the Final Conformity Rule (40 CFR Parts 51 and 93) direct the U.S. Environmental Protection Agency (EPA) to implement environmental policies and regulations that will ensure acceptable levels of air quality. The CAA require the Washington metropolitan area to adopt a structured, multi-year approach to attaining Federal clean air standards. The CAA and the Final Conformity Rule affect proposed transportation projects such

as the Purple Line. According to Title I, Section 101, Paragraph F of the amendments, "No federal agency may approve, accept or fund any transportation plan, program or project unless such plan, program, or project has been found to conform to any applicable State Implementation Plan (SIP) in effect under this act." The Final Conformity Rule defines conformity as follows:

> "Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not:
>
> i. cause or contribute to any new violation of any NAAQS in any area:
>
> ii. increase the frequency or severity of any existing violation of any NAAQS in any area; or
>
> iii. delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in any area."

Although there are many provisions in the CAA, the major focus for the region will be on reducing mobile sources such as automobile usage. Therefore, the likely effects of the study alternatives on regional air quality have been examined.

Attainment Status in the Corridor

Section 107 of the 1977 CAA requires that EPA publish a list of all geographic areas in compliance with the NAAQS, as well as those not in attainment of the NAAQS. Areas not in compliance with the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination are unclassified and are treated as attainment areas until proven otherwise. Areas that were designated as nonattainment when the CAA were implemented but have since attained compliance with the standards are classified as "maintenance areas." The designation of an area is made on a pollutant-by-pollutant basis.

Montgomery and Prince George's Counties were classified, between 1992 and 1995, as serious nonattainment areas for carbon monoxide (CO). They were reclassified as maintenance areas on March 3, 1996. The counties are currently classified as nonattainment areas for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) and ozone (O_3) and are classified as being in attainment for particulate matter less than 10 microns in diameter (PM_{10}), lead (Pb), and nitrogen oxide (NO_x).

Almost half of the emissions that cause ozone in the region come from cars, trucks, and buses. According to MWCOG analyses, motor vehicle emission burdens are projected to increase substantially by 2030. The Purple Line supports local and regional planning goals for air quality improvements by providing an alternative to automobile usage for those who work and live in the Purple Line corridor. The western segment of the Purple Line between Bethesda and Silver Spring is in the MWCOG Constrained Long Range Plan (CLRP) as a project. The eastern segment between Silver Spring and New Carrollton is in the plan as a study. The Maryland Department of Transportation is working to ensure that the eastern portion of the project is included in the CLRP as a project.

1.5. Public Involvement and Agency Coordination

Public involvement and agency coordination have been ongoing throughout the Purple Line study as an integral part of the alternatives development and evaluation process. Public input has provided valuable comments that informed decisions throughout this process, leading to the consideration of new alignment options and station locations and the elimination of other options.

The public outreach strategy for the Purple Line was designed with the following objectives:

- To foster two-way communication that provides opportunities for input and feedback from project stakeholders and ensures that concerns are adequately addressed;
- To reach out to all stakeholders, including residents, business owners, property owners, elected officials, agency representatives, and existing and future transit riders;
- To build on recent successes in outreach along the corridor;
- To help identify the range of issues to be addressed during all phases of the project; and
- To present information in consistent, readily accessible, and easy-to-understand formats.

The project's public involvement program provided numerous ways to receive information and provide comments. Outreach included project newsletters, fact sheets and flyers, a project website, public meetings, community meetings, Community Focus Groups, letters, and email. Meeting notices and newsletters were distributed to a mailing list that grew from approximately 16,000 individuals and businesses at the time of the scoping meetings to approximately 60,000 when community and public meetings were held. Seven newsletters have been issued, to provide project updates and announce opportunities for public input.

This section summarizes the major components of the public involvement and agency coordination efforts. Detailed information is presented in the *Public Outreach and Coordination Technical Report.*

1.5.1. Public Meetings

September 2003 Public Scoping Meetings

At the beginning of the Purple Line study in September 2003, four public scoping meetings were held in Bethesda, Silver Spring, Langley Park, and College Park. At these meetings, the public was able to comment on the study's key planning assumptions, identify issues of concern, and review the scope of the project's environmental analysis. These meetings provided an opportunity for the public to comment on the initial set of alternatives and identify issues that should be considered during the AA/DEIS process. For those unable to attend meetings, the meeting displays were available on the project website. Comments could be submitted electronically through the website or sent via mail.

The public scoping meetings were held in an "open house" format, where participants could conduct self-paced reviews of project displays. No formal presentation was given. Attendees could visit project information displays and aerial maps, and project representatives were available to answer questions.

Display boards presented the meeting's purpose, the project's background and goals, evaluation factors, and environmental considerations. They presented the alternative transit modes to be considered and described BRT and LRT options with examples and issues to be considered. The boards showed potential station locations, described the planning and environmental process, and presented the project's timeline and next steps. Maps were displayed showing the Purple Line corridor with environmental features and preliminary alignments for evaluation within the corridor. The public examined and

commented on the alternatives proposed for consideration.

A total of 377 people signed attendance sheets at the four meetings and over 350 comments were submitted during the scoping process. Comments covered a broad range of topics and stated approval or disapproval of general alignment issues and specific routes. Mode was the category that received the most comments, with numerous comments in favor of light rail. Over 70 percent of the comments submitted related to the alignment's location and whether it was above, below, or at ground level. Opposition to the Purple Line on Jones Bridge Road, MD 410 east of Silver Spring, and Sligo Avenue far outweighed support. The Interim Capital Crescent Trail (also referred to as the Georgetown Branch Trail), the environment, and station locations were the topic of many comments. Twelve stations were presented at the meetings, but the public suggested additional locations throughout the corridor. Other comments focused on transportation issues, public involvement, the planning process, and pedestrian safety.

November 2004 Public Open House Meetings

In November 2004, the MTA hosted five open houses on the Purple Line. These meetings were held in Bethesda, Silver Spring, Langley Park, College Park, and New Carrollton. A series of large aerial photographs showed the routes under consideration at that time. Display boards showed sketches and photos of LRT and BRT and how they could be incorporated into roadways.

Over 300 people attended these meetings to learn about the most recent project plans and talk with the project staff. MTA received 209 public comments. The most controversial topic was how the transitway would get from the Silver Spring Transit Center to the proposed Flower Avenue station: concerns were about property takings, the creation of a barrier through the community, safety, noise and vibration, and impacts to the Green Trail along Wayne Avenue.

The Georgetown Branch (or Master Plan alignment) generated both strong support and strong opposition. Community members expressed strong concerns about preserving the Interim Georgetown Branch Trail and the natural environment. A number of people asked for more details on how MTA proposes to include both the hiker/biker trail and the transitway within the Georgetown Branch right-of-way.

At these meetings, the public expressed support for the proposed station locations. Suggestions for several additional stations were made, particularly at East West Highway and Kenilworth Avenue, and the University of Maryland at US 1. Support was expressed for both BRT and LRT transit modes.

June 2006 Public Open House Meetings

Additional open houses were held in June 2006. These meetings were held in the evenings in Bethesda, Silver Spring, Langley Park, and College Park. Similar to the meetings in 2004, a series of large aerial photographs showed the alignments under consideration at that time. Display boards showed sketches and photos of LRT and BRT and how they could be incorporated into roadways. At these meetings, the MTA was seeking public input on station locations and the alternatives retained for detailed study in particular.

Other information presented at these meetings included:

- The trail along the Georgetown Branch right-of-way
- Traffic impacts and how they are studied
- The identification of cultural resources within the corridor
- Goals and objectives of the project
- Environmental resources being studied
- Photo simulations showing how the project could be incorporated on some of the roadways in the corridor
- Public outreach efforts, with special attention on Community Focus Groups

Approximately 300 people came to these meetings to learn about the most recent project plans and talk with project representatives. MTA received 110 comments. In general, the public expressed support for the project and most comments were positive. Many comments identified issues of concern (e.g., the need to maintain pedestrian access to the Interim Capital Crescent Trail). Many stated clear support for LRT, while a few expressed support for BRT. There was some support for the use of heavy rail. The most controversial alignment continued to be the use of the Georgetown Branch right-of-way. Some expressed strong support for this alignment, not only because it is the most direct route and unimpeded by traffic, but also because this alignment is readily available. Concerns about pedestrian safety, noise and vibration, and traffic were raised.

December 2007 Open House Meetings

The fourth round of open house meetings was held in December 2007. These meetings focused on the overall end-to-end Build alternatives. Preliminary data on estimated ridership, costs, and travel times was presented. Meetings were held in five locations in the corridor: Bethesda, Silver Spring, Langley Park, College Park, and West Lanham Hills.

These meetings were conducted using the previously well received format where people could attend at any time during the scheduled hours, review information at their own pace, and discuss issues and ask questions of project representatives. Maps showed the alternatives in relation to other transit services and to environmental resources. Display boards provided information on the Purple Line, project needs and benefits, photos of LRT and BRT systems and stations, the alternatives under consideration, typical sections, projected ridership, and cost estimates. They also presented the FTA's process, traffic studies, travel times, environmental resources, and details on special study areas such as the Interim Capital Crescent Trail and the University of Maryland campus.

Over 470 people attended these meetings and 205 written comments were submitted. Many voiced strong support for the project while others voiced their opposition. Concerns were raised about specific issues. These concerns included traffic, pedestrian safety, noise, vibration, impact to the Interim Capital Crescent Trail, and impacts to the environment in general. There was concern that the Purple Line study address BRAC's plans for Bethesda Naval Hospital and NIH. People discussed their opinions on station locations.

Where mode preference was expressed, a large number of people voiced a preference for LRT. Many community members wanted to get information on how the ridership numbers were developed.

May 2008 Open House Meetings

A fifth round of open house meetings was held in May 2008. These meetings were a final opportunity for the public to meeting with the MTA prior to the Public Hearing. Over 340 people attended and 117 comments were submitted. These meetings focused on the refined results of the alternatives analysis and provided project visualizations and updated results of ridership projections, costs, and environmental

impacts. As had been used before, the format was an informal self paced review of boards with project representatives.

Open House Meeting in College Park

Community Focus Groups

In an effort to gain a more local perspective on the project, MTA formed eight Community Focus Groups along the corridor. These groups were small, geographically organized meetings to facilitate open discussions with local community representatives on issues specific to one community or to a portion of the corridor. These focus groups were:

- Master Plan
- Jones Bridge Road
- Lyttonsville/CSX Corridor
- Downtown Silver Spring
- East Silver Spring
- University Boulevard
- University of Maryland/College Park/Riverdale Park
- New Carrollton/West Lanham Hills

Multiple rounds of meetings were held with most Community Focus Groups. Meetings were scheduled as new information became available, and community representatives provided valuable insight and input on the development and evaluation of alternatives. The MTA gained valuable information from this effort, ranging from details on how local school buses circulate, to delivery vans double parking on narrow commercial streets. This information allowed the MTA to better design the project and develop plans to address community concerns. Modifications were made to alignments, the number and locations of stations being evaluated were adjusted, and some alignments were dropped altogether, in part due to information and input received at these meetings.

Stakeholder Meetings

Since the initial scoping meeting, the MTA has provided over 280 briefings at the request of community, business, or other stakeholder groups. Outreach has included meetings with individual property owners, businesses, community associations, environmental groups, local government agencies, transit advocacy groups, developers, business associations, special interest groups, and other stakeholders. Briefings were generally held at stakeholder groups' request and in the format and location of their choosing, although on occasion the MTA proposed these meetings when a need for more coordination or information was identified. The MTA continues to advertise its willingness to meet with any interested individual or group.

1.5.2. Additional Outreach

Throughout the course of the project's planning study, the MTA has used a variety of outreach methods to identify communities and stakeholders that may be under-represented. The MTA has worked with local jurisdictions, elected officials, business leaders, local churches, and advocacy groups to reach out to community members. Newsletters, fact sheets, and comment sheets have been provided in both English and Spanish.

1.5.3. Agency Coordination

Environmental and regulatory coordination for the Purple Line was initiated at an agency coordination/scoping meeting on September 25, 2003. Invitation letters were extended to 22 regulatory and public agencies. Agency representatives and project staff in attendance included:

- Federal Transit Administration
- Federal Highway Administration
- U.S. National Marine Fisheries
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers
- Washington Metropolitan Area Transit Authority
- Metropolitan Washington Council of Governments
- Maryland Historical Trust
- Maryland Department of Natural Resources
- Maryland State Highway Administration
- Maryland Department of Planning
- Maryland Department of the Environment
- Maryland-National Capital Park and Planning Commission – Montgomery County
- Maryland-National Capital Park and Planning Commission – Prince George's County
- Montgomery County Department of Public Works and Transportation
- Prince George's County Department of Public Works and Transportation

At this meeting, MTA staff presented the Purple Line history and the decision to combine the Georgetown Branch Transitway/Trail project and the Purple Line East project and reconsider bus-based alternatives and new LRT alignments. MTA then reviewed the project goals on which the purpose and need were based, and presented the project alternatives being considered. Agency representatives asked questions and commented on a variety of topics, including fuel type usage for bus as compared to light rail alternatives, quality of service, alternative modes being considered (other than LRT and BRT), additional proposed stations in Prince George's County, and engineering issues. Agencies were encouraged to provide comments at the meeting and to submit written comments.

An agency field tour was conducted on December 2, 2003. This gave agency representative an opportunity to see the corridor and discuss issues. Some preliminary proposed alignments were dropped at this time because of resource agency concerns about environmental impacts.

Three interagency meetings were held over the next three years, in conjunction with several Project Team meetings (see the following section for a discussion of Project Team meetings). The dates of these meetings were October 1, 2004, April 29, 2005, and April 7, 2006. All meetings provided project updates. The October 2004 meeting focused on the screening process used to evaluate the alignments. The April 2005 meeting gave a detailed presentation of the alignments being carried forward at that point. The April 2006 meeting reviewed the status of the environmental analysis and the need for a second maintenance and storage facility site.

As the alternatives were further refined, additional potential station locations were identified and more detailed information on potential impacts was developed. A second

agency field tour was conducted on November 8, 2007. This gave agency representatives another opportunity to discuss project-related issues.

In addition to the larger agency coordination meetings and field reviews, individual agency coordination was conducted throughout the study, as appropriate.

1.5.4. Project Team Meetings

The Project Team includes representatives from the following state, local and regional governments:

- Maryland State Highway Administration
- Metropolitan Washington Council of Governments
- Maryland-National Capital Park and Planning Commission – Montgomery County
- Maryland-National Capital Park and Planning Commission – Prince George's County
- Montgomery County Department of Public Works and Transportation
- Prince George's County Department of Public Works and Transportation
- Local municipalities of Takoma Park, College Park, Riverdale Park, and New Carrollton
- Washington Metropolitan Area Transit Authority.

The Project Team has met 13 times over the course of the project's study, to present and discuss issues and preliminary findings, and inform project decisions.

1.6. Evaluation of Alternatives

The evaluation of alternatives is the key component of the Alternatives Analysis process and should contain sufficient information to distinguish between the costs and benefits of the alternatives and to understand the relationships among alternatives, including possible trade-offs. Although the evaluation of alternatives occurs near the end of the Alternatives Analysis process, the development of an evaluation methodology and definition of supporting measures occurs at the beginning of the project to ensure that the correct information is produced in the analytical phase for application of the measures.

The evaluation of the transportation improvement alternatives for the Purple Line draws on the information and analyses gathered from the analysis of the corridor and input from stakeholders. The measures were developed from the goals of the project. The framework for the evaluation involves the following:

- Effectiveness – how well each alternative addresses the purposes of the project
- Cost-effectiveness – the extent to which an alternative provides a level of benefits that is commensurate with its cost, and relative to the other alternatives
- Financial feasibility – the extent to which sufficient funding is available, or can be developed to construct, operate, and maintain the alternatives
- Equity – how well each alternative provides a fair distribution of costs and benefits to the various subgroups and communities in the corridor

This evaluation framework is designed to support the decision-making process regarding the choice of transit improvements in the corridor. It has been followed in the belief that it provides the qualitative and quantitative material needed for decision making in a manner that will successfully build a consensus among those concerned with the selection and implementation of a Locally Preferred Alternative.

1.6.1. Measures

To perform this evaluation, a number of measures were developed based on the following goals of the project:

- Improving mobility and accessibility
- Improving transit operations efficiencies
- Optimizing public investment
- Enhancing environmental quality
- Supporting local plans for economic and community development
- Support attainment of regional clean air goals

Specific objectives were developed to meet each of these goals, and, for each objective, evaluation measures were identified. The alternatives are evaluated using a variety of measures relevant to each objective, some qualitative, such as equity considerations and community quality, and some quantitative, such as financial feasibility. Sources for these measures include FTA guidance; the New Starts Criteria, including the Summit model; and corridor-specific needs and issues. The evaluation of the transportation improvement alternatives draws on the information and analyses gathered from the analysis of the corridor, as well as input from stakeholders.

Table 1-9 lists the project objectives and some of the measures used to differentiate among the alternatives. Some different objectives are evaluated with the same measures.

Table 1-9: Objectives and Corresponding Evaluation Measures

Objective	Evaluation Measure
Improve Mobility and Accessibility	
▪ Improve accessibility to existing and planned economic development areas in the corridor ▪ Improve access to jobs in corridor ▪ Increase employers' access to labor pool	User Benefits by alternative, 2030 (daily minutes)
	Percent over TSM
	User Benefits with mode-specific attributes by alternative, 2030 (daily minutes)
	Percent over TSM
	Accessibility of residents to employment: jobs within ¼ to ½ mile of stations
	Accessibility of employers to workers: households within ¼ to ½ mile of stations
▪ Reduce travel time between major activity centers: o Bethesda – Silver Spring o Bethesda – Takoma/Langley o Bethesda – UM Campus Center o Silver Spring – Takoma/Langley o Silver Spring – Riverdale Park o Silver Spring – UM Campus Center o Silver Spring-College Park Metro o Takoma/Langley – Riverdale Park o East Silver Spring – Silver Spring o East Silver Spring – Takoma Langley o New Carrollton – Riverdale Park o New Carrollton – University of Maryland o New Carrollton – Silver Spring	Peak transit travel times for alternatives in 2030 (minutes)
▪ Improve mobility for transit-dependent households	Number of zero-car households within ¼ mile of stations
Improve Transit Operations Efficiencies	
▪ Increase interconnectivity of transit system, including bus-to-bus and bus-to-rail transfers	Number of routes connecting at major transfer points
▪ Integrate radial Metrorail and MARC lines for better transit system connectivity ▪ (also see below under Increase regional transit usage)	Transfer walk time Number of transfers required to access major activity centers
▪ Increase reliability of transit service	Comparison of running way characteristics (miles): ▪ Dedicated ▪ Exclusive ▪ Shared (with traffic)
	Comparison of vertical alignment type (miles): ▪ Aerial ▪ Surface ▪ Tunnel
▪ Increase regional transit usage ▪ Integrate radial Metrorail and MARC lines for better transit system connectivity	End-to-end peak period running times Bethesda to New Carrollton (minutes)
	Transit ridership (daily boardings) ▪ Purple Line ▪ Purple Line via Metrorail ▪ Purple Line via MARC ▪ Total
	New transit trips relative to No Build
	Percent new trips relative to No Build
▪ Reduce transit travel times in the corridor	Change in operating speeds of transit service
	Change in travel time between major activity centers
▪ Serve transit oriented populations	Number of zero-car households within ¼ and ½ mile of stations

Table 1-9: Objectives and Corresponding Evaluation Measures (continued)

Objective	Evaluation Measure
Enhance Environmental Quality	
▪ Minimize and mitigate impacts to the natural and human environment in the corridor ▪ Provide a safe and attractive transit service that is compatible with local community character	Direct impacts to the natural environment
	Direct impacts to parklands
	Direct impacts to historic properties
	Visual effects
	Direct residential property impacts (number of displacements)
Optimize Public Investment	
▪ Demonstrate that the overall benefits of the transit improvements warrant their capital and operating costs	Total capital cost ($2007 in million)
	Annual operating and maintenance costs ($2007 in millions)
	Annual increase in operating subsidy ($2007 in millions)
	FTA cost-effectiveness measures (cost per hour of User Benefit)
	Incremental Cost per New Transit Rider
Support Local Plans for Economic and Community Development	
▪ Support local, regional, and state policies and adopted master plans	Consistency with local, regional, and state policies and adopted master plans
▪ Support potential for transit oriented development at existing and proposed stations in support of local land use plans	Number and size of transit oriented development opportunities
	Potential for new development
Support Attainment of Regional Clean Air Goals	
▪ Support attainment of regional air quality goals	Change in regional emission burden

Chapter 2
Alternatives Considered

Chapter 2. Alternatives Considered

2.1. Alternatives Development Process

The MTA has examined a wide range of modes and alignments throughout the long history of this project. In 2003, when the east and west portions of the project were combined and the MTA held a series of public scoping meetings to reinitiate the study, the mode choices were narrowed down to BRT and LRT. The MTA focused on determining the alignments that would best meet the purpose and need, while minimizing impacts and optimizing the service provided. As required by the FTA in an AA, the MTA worked to develop alternatives that all met the purpose and need but had real differences. Three alternatives were established for each mode at varying levels of investment to compare the benefits and costs.

The alternatives definition has been an iterative process that involved extensive coordination with local stakeholders, including local planning agencies, major employers, elected officials, community groups, property owners, and local residents. The MTA held regular meetings throughout the study with a project team that included local planners, state and county agencies, and elected officials to ensure that the Purple Line was consistent with local goals and that the MTA was informed of local issues.

The MTA conducted an extensive public outreach process. The MTA maintained a project website, mailed newsletters to a mailing list of over 60,000 households and businesses, and held large public open houses. The MTA met with community and civic associations over 280 times between 2003 and 2008 to discuss the project and solicit input from local stakeholders. Beyond this, the MTA developed a community engagement process called "Community Focus Groups." The MTA organized eight of these groups along the corridor to provide a forum for discussion with local residents on issues and concerns relative to their communities.

Community Focus Groups

In the fall of 2004, the MTA created a forum for discussion of the project from a local perspective. The goal was to have small, geographically organized meetings focused on local community issues relative to the Purple Line. In some communities along the corridor, the challenge was not getting people to come to community meetings, but getting a small enough number that would allow for a dialogue rather than presentations. A format was developed with the aid and support of the local jurisdictions. Comprised of representatives of local community and civic associations, these groups met regularly with project representatives to discuss in detail local project plans. The focus groups proved to be an effective way to work with local communities. The MTA gained valuable information at the meetings about community concerns and about the local area. This information ranged from such issues as the details of the traffic circulation of local school buses to double parking by delivery vans on narrow commercial streets. In some cases, alignments were dropped; in others they were modified based on input received at these meetings. This information allowed the MTA to better design the project and develop plans that addressed community concerns.

Community Focus Group Meeting

Chapter 1 described the history of the project and its planning up until the definition of the project at the public scoping in September 2003.

Scoping

Scoping for the Purple Line study was an important part of the initial alternatives definition. This process, held in September 2003, was described in Chapter 1. The scoping process began with public notification of four public meetings and also included scoping for the resource agencies.

A wide range of alternatives were identified and suggested during the scoping process. In considering these alternatives, the MTA assessed alternatives for reasonableness and relevance to the project's purpose and need. Alternatives identified during the scoping process that did not support the purpose and need for the Purple Line were not considered "reasonable alternatives" as described in the FTA regulations implementing NEPA (23 CFR 771.123). Alternatives that did not pass the reasonableness standard were eliminated from further consideration in the AA/DEIS.

2.2. Modes

Two transit modes, heavy rail and monorail, were suggested during scoping and not carried forward for detailed study. In the previously completed *Capital Beltway/Purple Line Study – Findings and Recommendation Report (2003)*, heavy rail (Metrorail) and monorail were eliminated from consideration for the Purple Line corridor due to prohibitive costs and the availability of other viable alternatives.

A heavy rail alternative was eliminated from consideration for the Bethesda to Silver Spring segment in the 1996 Georgetown Branch Transitway/Trail MIS/DEIS due to excessive costs projections from the *East West Transitway Feasibility Study*. In July 2000, the MTA reexamined the comparative costs of several alignments between Bethesda and Silver Spring, including double track along the Georgetown Branch right-of-way and double track underground. This report projected the underground costs of approximately $926M and the surface alignment $292M because of the scale of the cost differential the MTA has not included Metro heavy rail in the study because it would require an underground alignment in this built up area.

The MTA has concluded that monorail technology does not offer appropriate solutions when compared to BRT and LRT. Comparing capital costs for recently constructed BRT and LRT systems around the country to a monorail system similar to the system developed in Las Vegas, Nevada, indicates that a monorail would not likely offer any cost savings. In addition, a monorail would not likely be able to meet the capacity needs associated with this corridor. Higher capacity monorail systems could be constructed, but because the larger vehicles must straddle a larger beam, heavier structures would

have to be built and, as a result, turning radii would need to be larger creating substantial visual and property impacts on adjacent communities.

Neither of these modes meets the goal of a cost-effective transit alternative that is rapid, reliable, and environmentally friendly; therefore, the MTA has eliminated monorail and heavy rail alternatives from consideration.

Two transit modes are being considered for the Build alternatives, BRT and LRT.

Low Floor BRT Vehicle

BRT is a mode of transportation that has characteristics in common with both conventional bus operations and LRT. BRT looks and feels much like a railcar but uses rubber wheeled vehicles. It can operate either on city streets or in a separate busway. BRT is generally faster than traditional local bus service. Like a rail system it has permanent stations, services, and amenities. Vehicles are typically fueled with low emission hybrid electric motors or Compressed Natural Gas. BRT vehicles typically are low floor, making them easier to board, and often have several doors for faster boarding.

Features generally associated with a BRT system include signal priority at intersections, queue jump lanes, and off board fare collection. One advantage of BRT service is that the buses are not restricted to a specially constructed guideway but can operate on regular streets to provide "one seat" feeder bus service.

Traffic signal priority is simply giving special treatment to transit vehicles at signalized intersections. The system can give an early green signal or hold a green signal that is already displaying as a transit vehicle approaches.

A queue jump lane is a short stretch of bus lane often combined with traffic signal priority. The idea is to enable buses to by-pass waiting queues of traffic and to cut out in front by getting an early green signal. A special bus-only signal may be required. The queue jump lane can also be a right-turn only lane, permitting straight-through movements for buses only.

Both of these techniques can be used to improve transit travel times and reliability.

BRT is new to Maryland, but not to many communities around the world. American cities such as Pittsburgh and Seattle have long benefited from BRT, which can provide the following:

- Lower capital cost
- Cost-effective alternatives
- High-quality service
- High-performance rapid transit service that can be quickly implemented
- Medium- to high-capacity service

LRT is an electric railway system that can operate single cars or short trains. LRT can operate in shared lanes, like traditional streetcars, or in a separate right-of-way. When light rail operates on existing streets in dedicated rights-of-way, signal priority can be used to ensure that the LRT vehicles are not delayed by traffic signals.

A growing number of cities in the United States have LRT systems, including Dallas, Portland, Denver, St. Louis, and San Diego. LRT systems can provide the following:

- Cost-effective alternatives
- High-quality service
- High-performance rapid transit services
- High-capacity service

LRT in Houston

For each mode, low, medium, and high investment alignment alternatives are being evaluated, representing increasing levels of capital investment. All of the Build alternatives extend the full length between the Bethesda Metro Station and the New Carrollton Metro Station. The intent is that these alternatives, while all serving the same markets and providing improvements in the quality of the transit service through improved operating speeds and reliability, vary in the type of running way (shared, dedicated, or exclusive) and amounts of grade separation (tunnel or aerial structure).

Types of Running Way

Shared means that the transit vehicles operate on the street mixed in with regular traffic.

Dedicated means that the lanes are intended for the sole use of transit vehicles, but these lanes can be easily crossed by pedestrians and other vehicles or used by emergency vehicles. Dedicated lanes are often indicated by pavement makings, signage, or different pavement treatments.

Exclusive lanes are not accessible to other vehicles. They are usually physically separated from other traffic, either by being in a tunnel or on an aerial structure, or if in or alongside an existing roadway, by barriers of some kind.

This framework will enable evaluation of the incremental mobility benefits and changes in environmental and community effects relative to incremental capital costs.

Much of the Purple Line alignments would run along existing roadway rights-of-way. Medium and high investment alternatives would have some tunnel sections that would not necessarily follow roadway alignments. With the exception of the Low Investment BRT Alternative, all Build alternatives follow the former Georgetown Branch railroad right-of-way, (often referred to as the Master Plan alignment because of its adoption in the Georgetown Branch Master Plan in 1986); in combination with a one-mile segment along the CSX Metropolitan Branch

railroad right-of-way between Bethesda and Silver Spring.

2.3. Alignments

Several specific alignments initially suggested received substantial negative feedback from the public as well as city and county councils during the scoping process.

The segment of MD 410, extending east from Bethesda and continuing east of Silver Spring, was not carried forward due to several factors, including a very narrow right-of-way that would have extensive property impacts, grades that were very steep and on which it would be difficult for light rail transit to operate, opposing comments from a large segment of the public, and a City of Takoma Park resolution in October 2003 that recommended elimination of this alignment from further study. In addition, this alignment east of Silver Spring would not have served the Flower Avenue area, which Montgomery County has targeted for improved transit to support economic development and revitalization. The Flower Avenue area is a small commercial area, also known as Long Branch centered on the intersection of Flower Avenue and Piney Branch Road. The Arliss Street station is in this area and would provide improved access to the businesses for customers.

An underground alignment extending from Paint Branch Parkway and Good Luck Road to Riverdale Road along Brier Ditch was eliminated from further consideration due to concerns from the U.S. Army Corps of Engineers (USACE) about impacts to wetlands in the area.

Another alignment presented at the scoping meetings that received strong opposition from the surrounding community and the City of New Carrollton was an alignment that extended from Riverdale Road and continued behind the New Carrollton Mall and Shopping Center. This alignment was not carried forward due to this opposition and the potential for greater community impacts than the other alignments under study.

The screening process was iterative throughout the study and included consideration of natural and social environmental impacts, preliminary cost estimates, and input from the public and agencies. As described earlier, the Purple Line study had an extensive public outreach program and met regularly with local community representatives and local jurisdictions. The alignments were refined extensively based on this input.

An example of this type of refinement was the modification of the original Silver Spring/ Thayer Avenue design option. This alignment originally cut through the center of Montgomery County Public Parking Lot #3 on Fenton Street, which the County planned for redevelopment. The MTA coordinated with the County and the developer to modify the alignment so as not to preclude the proposed development.

A number of other alternatives were dropped from further consideration as part of the AA/DEIS process. The following is a brief discussion of why these alignment options have been dropped from further consideration.

The Metrorail (or Purple Line) Loop

The Metrorail Loop alignment was proposed by Montgomery County Executive Duncan in January 2003. This proposed Metrorail (heavy rail) alignment would have extended from the existing Medical Center Metrorail Station in Bethesda north via a tunnel under the Capital Beltway and along the north side of the Beltway, primarily on an aerial structure. It would then cross back over the Beltway, continuing south along the Metropolitan Branch CSX corridor either in a retained cut or in a tunnel to the Silver Spring Transit Center (SSTC). This alignment would be a continuation of the Metrorail Red Line and, as such, it would have been heavy rail and would not have continued past the Silver Spring Transit Center in the same mode.

Both the MTA and M-NCPPC carried out assessments of this proposed alignment.

The MTA concluded that while the Metrorail Loop could improve operations and provide redundancy for the Metrorail Red Line; these advantages would not have applied to the Purple Line corridor as a whole. Implementation of the Metrorail Loop would not have addressed the issues of system connectivity, mobility, accessibility, and efficiency for the entire corridor that are part of the Purple Line Purpose and Need. Passengers traveling between the Metrorail Loop and destinations east of Silver Spring would have been required to transfer from the Metrorail Loop to BRT or LRT to complete their travel farther east. This alignment would not have provided continuous service for destinations between Bethesda and New Carrollton and would not have addressed the issues of an inadequate and slow-moving transportation network for east-west travel between Bethesda and New Carrollton. Further, substantial natural and human environmental impacts are associated with the Metrorail Loop option. This alignment would have required acquisition of right-of-way from Rock Creek Park along the Capital Beltway. This alternative would have also required property from approximately 25 residences along the CSX right-of-way. The Metrorail Loop would not have supported economic and community development west of Silver Spring because there would be no stations at the Chevy Chase and Lyttonsville communities. Moreover, this alignment would have been a less cost-effective solution to addressing the transportation problems and needs associated with the Purple Line corridor compared to a BRT or LRT alternative for the entire 16-mile corridor. The *Metrorail Loop Proposal Alignment Evaluation* is included in the *Definition of Alternatives Report*.

In January 2003, M-NCPPC issued a report recommending that the Metrorail Loop not be carried forward for further study. While recognizing the benefits to the existing Metrorail system, M-NCPPC recommended that the proposal not be carried forward due to a number of considerations. These included: the high cost of the project (estimated at twice that of the Purple Line), lower cost-effectiveness, greater impacts to the natural environment, the inability to serve communities between Bethesda and Silver Spring, and impact to the outer Red Line stations (stations north of Medical Center and Silver Spring). The *M-NCPPC Purple Line Loop* memorandum is included in the *Definition of Alternatives Report.*

LRT on Jones Bridge Road

The availability of the Georgetown Branch right-of-way, owned by Montgomery County and designated for use as a transitway and trail, and the potential to build a transitway within a nearly exclusive operating environment with few grade crossings, provide the opportunity for a transit service unimpeded by traffic conflicts and therefore allowing for reliable service and faster travel times between Bethesda and Silver Spring. However, the capital cost of constructing a transitway and trail along this alignment is relatively high, so a lower cost BRT alternative using Jones Bridge Road is being considered between Bethesda and Rock Creek. This alternative consists of in-street running BRT along Jones Bridge Road and Jones Mill Road and along Woodmont Avenue west of Jones Bridge Road connecting to downtown Bethesda. For BRT this is indeed lower cost, since the buses would be operating on existing roadways; however, light rail service along Jones Bridge Road would require reconstruction of the street

for the installation of rails and catenary, and therefore would not offer the same savings over the Master Plan alignment. For this reason, Jones Bridge Road is not being considered for light rail.

BRT and LRT on Brookville Road

An alternative along Brookville Road had been proposed as a lower cost alternative, particularly for BRT, which could operate on the existing road. However the need to construct a transitway from Brookville Road along the CSX tracks would have negated the savings and resulted in additional property impacts. In addition, the Brookville Road alignment would have slower travel speeds and potential traffic conflicts with existing traffic for both BRT and LRT. The alignment also interfered with the layout of the maintenance and storage facility on Brookville Road.

16th Street to East West Highway to Colesville Road (BRT only)

In this low investment BRT option the buses left the CSX corridor at 16th Street and continued on 16th Street to East West Highway and then on to Colesville Road to Wayne Avenue. This option had very poor travel times because of high levels of traffic and several major intersections. The Spring Street to 2nd Avenue at-grade option provides much faster service with similar costs.

BRT and LRT from CSX at Spring Street to 2nd Avenue to Wayne Avenue

The LRT option required an aerial structure over Colesville Road because of steep grades on 2nd Avenue. This alignment had no direct connection with the Silver Spring Transit Center and would have required passengers to walk through or around the proposed private development to reach the Transit Center. This poor connectivity is contrary to the goals of the Purple Line. The structure would have had high costs, impacts to the residences on 2nd Avenue, visual impacts to downtown Silver Spring, and traffic impacts to access into the Metro Plaza building. The BRT aerial crossing of Colesville Road along 2nd Avenue was also dropped due to high costs and impacts to adjacent properties.

Tunnel from Sligo Avenue and Piney Branch Road Directly to Takoma Langley Crossroads

This alignment followed Sligo Avenue to Piney Branch Road where it descended into a tunnel along the alignment of Park Valley Road and emerged near the intersection of University Boulevard and Anne Street. It would have been aligned to have a station near Columbia Union College and Washington Adventist Hospital in Takoma Park. This alignment was dropped because it did not support the Montgomery County Master Plans for economic redevelopment of the Flower Avenue station area. As noted earlier, the Flower Avenue area is a small commercial area, also known as Long Branch centered on the intersection of Flower Avenue and Piney Branch Road. The Arliss Street station is in this area and would provide improved access to the businesses for customers.

In addition, this alignment would be very costly compared to other alternatives. At the public meetings there was almost no public support for a station near the college and the hospital along this alignment option.

Sligo Avenue in East Silver Spring, both At Grade, and in Tunnel

The Purple Line alignment on Sligo Avenue at grade would have poor transit operations and major traffic impacts requiring either operation in shared lanes or one-way traffic. The traffic and parking impacts would have adversely impacted the 30 small businesses along this street. The narrow right-of-way would have necessitated substantial property impacts and easements. The Wayne Avenue at grade option provided a similar low investment surface option that would operate far better and have fewer community impacts.

A tunnel option under Sligo Avenue was also dropped. This was a high-cost option and would have had required substantial property easements. Tunnel segments of shorter lengths and less cost could be used more effectively on the Wayne Avenue or Silver Spring/Thayer alignments.

All Alignments along Colesville Road from the Silver Spring Transit Center

Several alignments were presented at scoping that would follow Colesville Road from the Silver Spring Transit Center. One alignment followed Colesville Road north to University Boulevard in Four Corners and turned south at the signalized intersection at University Boulevard. Another alignment followed Colesville Road north to East Franklin Avenue and traveled east to Flower Avenue and then south to Piney Branch Road to University Boulevard. A third alignment followed Colesville Road to East Franklin Avenue and then to University Boulevard.

Colesville Road is six lanes wide with a reversible center lane. It is a heavily used major arterial. Surrounding land uses are generally single-family residential, except in the Silver Spring CBD. The extremely heavy traffic on Colesville Road and constrained right-of-way would make it very difficult to implement dedicated or exclusive lanes for transit. In the 1990s, the Montgomery County Department of Transportation conducted a feasibility study for a busway on US 29 (Colesville Road). After this study, both the Montgomery County Council and M-NCPPC recommended that US 29 not be considered for either a busway or LRT. Because this alignment extends north above the Purple Line corridor and then comes south again before continuing east, it adds more than a mile of additional distance to the alignment. As a result, this alignment significantly lengthens the travel time and increases the operating cost, both of which are counterproductive to the project's goal of providing rapid transit service east-west in the corridor. For these reasons, this alignment was not being retained for detailed study.

Longer Tunnels under Wayne Avenue

Communities members concerned about the impacts of a tunnel portal on Wayne Avenue near Dale Drive requested that the MTA evaluate a longer tunnel. Two tunnels were considered, both descending into tunnel from Silver Spring Avenue west of Georgia Avenue. The first tunnel considered would have passed under Sligo Creek. However, because of the depth required to tunnel under the creek, and the rapidly rising topography east of the creek, this tunnel would not have been able to return to the surface until the alignment was on Piney Branch Road, at Barron Street. This would have been extremely expensive and would not have provided meaningful travel time benefits, therefore would have had substantial negative impacts to the cost-effectiveness of the project. The cost of underground stations is likewise very high, further escalating the cost of this option. For this reason this option was dropped. A second, shorter tunnel with a portal on Wayne Avenue between Sligo Creek and Mansfield Street was evaluated in an effort to find a more feasible option. This option, while less costly, would have had major adverse impacts to the residences on the south side of Wayne Avenue. These houses are above the grade of the roadway, with short steep driveways. The street widening required for a tunnel portal would have required property acquisitions from the front yards and driveways of these houses, and retaining walls in these yards. This option also required property from Sligo Creek Park. This tunnel did not

provide any travel time benefits, and added to the project cost. For both tunnel options the addition of stations was an issue. The high cost of underground stations weighed against their inclusion, but if stations were not included in these alignments the communities would not benefit from the project and ridership would be lower. It was determined that these tunnels did not provide sufficient benefit and had such a detrimental effect on the cost that further study was not justified.

University of Maryland Campus Alignment on Paint Branch Drive

This alignment followed University Boulevard northeast to Paint Branch Drive. At Paint Branch Drive it turned south, passing the University of Maryland's Comcast Sports Arena, and joined Campus Drive on the eastern edge of campus. While this alignment would have served the sports arena well and would have been heavily used during special events, it did not serve the central core of the University of Maryland campus. The campus is quite large and a central station location is more convenient for the greatest number of people.

Paint Branch Parkway to Kenilworth Avenue

This alignment continued east from River Road, just north of the College Park Metro Station on Paint Branch Parkway to Kenilworth Avenue. This alignment did not have good connectivity to the Metro Station and did not serve the University of Maryland's research park, M-Square, currently under construction along River Road. This research park will be a major ridership market.

In addition, Paint Branch Parkway is surrounded by wetlands and parklands. As a result, this alignment option would have had much greater environmental impacts and Section 4(f) issues than the River Road alignment option.

Section 4(f)

Since the mid-1960s, federal transportation policy has reflected an effort to preserve the beauty and integrity of publicly-owned public parks and recreation areas, waterfowl and wildlife refuges, and historic sites considered to have national, state, or local significance. The Department of Transportation Act of 1966 (DOT Act) included a special provision to carry out this effort: Section 4(f).

Section 4(f) of the DOT Act stipulated that the Federal Highway Administration (FHWA) and other DOT agencies cannot approve the use of land from a significant publicly-owned public park, recreation area, wildlife or waterfowl refuge, or any significant historic site unless the following conditions apply:

- There is no feasible and prudent alternative to the use of land.
- The action includes all possible planning to minimize harm to the property resulting from use.

Paint Branch Parkway to CSX Corridor to East West Highway

This alignment paralleled the CSX and WMATA alignments south from the College Park Metro Station and turned east on East West Highway. This alignment required the use of the CSX right-of-way. CSX has stringent separation requirements that would have added considerably to the project cost. It also did not serve the University's M-Square Research Park currently under construction along River Road.

River Road to Lafayette Road serving Riverdale MARC Station

The MTA evaluated several alignments, which paralleled the CSX tracks along Lafayette Road to the Riverdale Station of the Camden MARC line before turning left onto East West Highway. While these alignments provided connectivity to the Riverdale Station, and could have supported economic development at this location, the alignment was constrained by the existing residential development and narrow roadways. The engineering constraints added between four and eight minutes of travel time between College Park and Riverdale Park over the at grade and tunnel options.

River Road to 51st Avenue to East West Highway

This alignment followed River Road from the College Park Metro Station and proceeded on a new surface alignment south connecting to 51st Avenue to East West Highway. This alignment presented Section 4(f) issues with impacts to Anacostia River Park. 51st Street is a small residential street, and an alignment on it would have had major community impacts. These impacts are easily avoided by using other alignments; therefore this alignment was dropped from further consideration.

Tuckerman Street between Kenilworth Avenue and Veterans Parkway

This alignment began at the intersection of Kenilworth Avenue and River Road and proceeded east in a tunnel under Tuckerman Street with a narrow right-of-way under residences and commercial and county structures, and then crossed under East West Highway and emerged on Veterans Parkway. This alignment was dropped because of high costs and many required underground easements, and because it bypassed an important transit stop at Kenilworth Avenue and East West Highway.

Riverdale Road from Veterans Parkway to Annapolis Road

The Riverdale Road alignment was an option for BRT only because of the steep grades. The alignment had travel times approximately 40 percent longer that those for Veterans Parkway because of the cross streets and the narrower, tight curves of the roadway. Unlike Veterans Parkway, there were potential residential impacts. This option was strongly opposed by residents of the area and by the City of New Carrollton. Given the existence of a viable surface alternative on Veterans Parkway, this alignment was dropped.

Constrained Long Range Plan

The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) mandate that each urbanized area with a base population of 50,000 or more must have an organized planning process that results in a transportation plan consistent with the planned development for the area. The Constrained Long Range Transportation Plan includes all regionally significant transportation projects and programs that are planned and funded in the region through the next 25 years.

Annapolis Road to Emerson Place

This alignment option began at Annapolis Road and Harkins Road, but left Harkins Road to pass to the west of the Internal Revenue Service building and parking structure, then continued on Emerson Place. This alignment was dropped because of its greater potential for community impacts and because it was not substantially different from the Harkins Road alignment, which has few impacts to local residents. This

alignment was opposed by the West Lanham Hills community.

2.4. Alternatives Retained for Detailed Study

The Purple Line study is evaluating a No Build alternative, a Transportation Management System Alternative, and six Build alternatives.

2.4.1. Alternative 1 – No Build Alternative

Federal regulations require that a No Build alternative be evaluated in an Environmental Impact Statement (EIS). For NEPA purposes, the No Build alternative is the baseline against which the other alternatives are compared for the extent of environmental and community impacts. The No Build alternative assumes that no new improvements would be made to the transportation system in the study corridor, other than those that are currently in local and regional transportation plans and that have identified funds for implementation by 2030. Thus it consists of the transit service levels, highway networks, traffic volumes, and forecasted demographics for the horizon year of 2030 that are assumed in the Constrained Long Range Plan (CLRP) of the local metropolitan planning organization (MWCOG, in this case).

The western segment of the Purple Line, the former Purple Line West, Bethesda to Silver Spring, is in the CLRP as a project; the eastern portion, Purple Line East, Silver Spring to New Carrollton, is in the CLRP as a study. However, the Purple Line is not assumed as part of the No Build travel demand model.

The following two projects in the CLRP are major projects in Maryland, but not in the Purple Line corridor:

- The Intercounty Connector is the major highway project in the area and is not expected to have a measurable impact on travel within the Purple Line corridor as it serves different travel markets. Likewise, planned US 29 intersection changes are also not expected to have an impact on the Purple Line.
- The Corridor Cities Transitway (CCT) from Shady Grove to COMSAT is a committed study, but it is sufficiently far from the Purple Line that there is not expected to be any synergy between the two. It should be noted that the CCT is not included in the future transportation network in the travel forecasting model.

Maryland Consolidated Transportation Program

The Maryland Department of Transportation's (MDOT) Consolidated Transportation Program (CTP) is a compilation of all transportation projects currently funded for construction or development and engineering by Governor Martin O'Malley. These projects are funded utilizing the financial resources of the State's Transportation Trust Fund. The Transportation Trust Fund is used to pay for State capital transportation projects throughout Maryland. It is fueled by revenues from State vehicle titling and registration fees, gas taxes, a portion of the corporate income tax and federal funds.

Each fall, at the direction of the Governor, the Transportation Secretary and senior members of the MDOT staff travel to every county in the State, and Baltimore City, to meet with elected officials and citizens. The purpose of these meetings is to brief members of the community and obtain their input on transportation enhancements planned for a specific county or region over the six-year period covered by the CTP. With this input, a final CTP is developed and submitted to the General Assembly each year for its approval.

Highway, transit, pedestrian, and bicycle projects and studies in the Purple Line corridor included in the Maryland Consolidated Transportation Program (FY 2007-2012) within the corridor are as follows:

- US 1 (Baltimore Avenue): Reconstruct US 1 between College Avenue and Sunnyside Avenue to improve traffic operations, pedestrian circulation, and safety; it would also accommodate planned revitalization within College Park (project)
- New Hampshire Avenue/University Boulevard: Streetscape and safety improvements for MD 650 from Holton Lane to Merrimac Drive and MD 193 from 800 feet west of MD 650 to 800 feet east of MD 650 (project)
- Construction of the Silver Spring Green Trail, an 8-foot-wide bicycle/pedestrian trail on Wayne Avenue from the Silver

Silver Spring Transit Center

Spring CBD to Sligo Creek Parkway (project)

- Bethesda Bikeway and Pedestrian Facilities, streetscape improvements (project)
- College Park Trolley Trail, construct shared-use path (project)
- I-95/I-495, Capital Beltway, from American Legion Bridge to Woodrow Wilson Bridge (study)
- UM Connector, I-95/495 to University of Maryland (study)
- Widening of Kenilworth Avenue from four to six lanes north from River Road to Pontiac Street (project)

Other committed projects in the Purple Line corridor include the following:

- Construction of the Silver Spring Transit Center. This project provides a fully integrated Transit Center at the Silver Spring Metrorail Station. It includes construction of bus bays for Metrobus and Ride On, an intercity bus facility, a taxi queue area, a kiss-and-ride facility, and a MARC ticketing office. Provision is also made for the Purple Line and a hiker/biker trail.
- Construction of the Takoma/Langley Transit Center. The project is a joint effort between MTA and SHA. It will include pedestrian safety, roadway and intersection improvements, new sidewalks and crosswalks, and the provision of shelter for patrons awaiting buses. The Transit Center will be on the northwest corner of the University Boulevard and New Hampshire Avenue intersection in Langley Park. This Transit Center would be a station on the Purple Line.
- Design and construction of a new entrance to the Bethesda Metro Station mezzanine at the south end of the platform.

WMATA is currently pursuing additional joint development projects at the College Park and New Carrollton Metro Stations. These projects will be mixed-use developments that will take advantage of the Metro stations to provide improved mobility and accessibility. The market for transit at these stations is expected to grow.

The recent decision to close Walter Reed Army Hospital and move a large number of staff and services to the National Naval Medical Center under the Base Realignment and Closure (BRAC) will create a slightly larger market for transit at the Bethesda and National Institutes of Health (NIH) Metro Stations. The National Naval Medical Center anticipates an increase of approximately 2,200 to 2,500 employees of which an estimated 60 new riders would use the Purple Line.

Existing Transit Service

Existing transit operating east-west within the corridor consists of several overlapping or interconnecting routes, as shown in Figure 2-1. WMATA operates regional routes, those that are inter-jurisdictional, while each of the counties operates local routes. Table 2-1 lists the existing east-west transit services and their general characteristics.

2.4.2. Alternative 2 – TSM Alternative

As described by the FTA, transportation system management (TSM) alternatives are relatively low-cost approaches to addressing transportation needs in the corridor. The TSM alternative represents the best that can be done for mobility without constructing a new transit guideway. Generally, the TSM alternative emphasizes upgrades in transit service through operational

Figure 2-1: Existing Transit Service

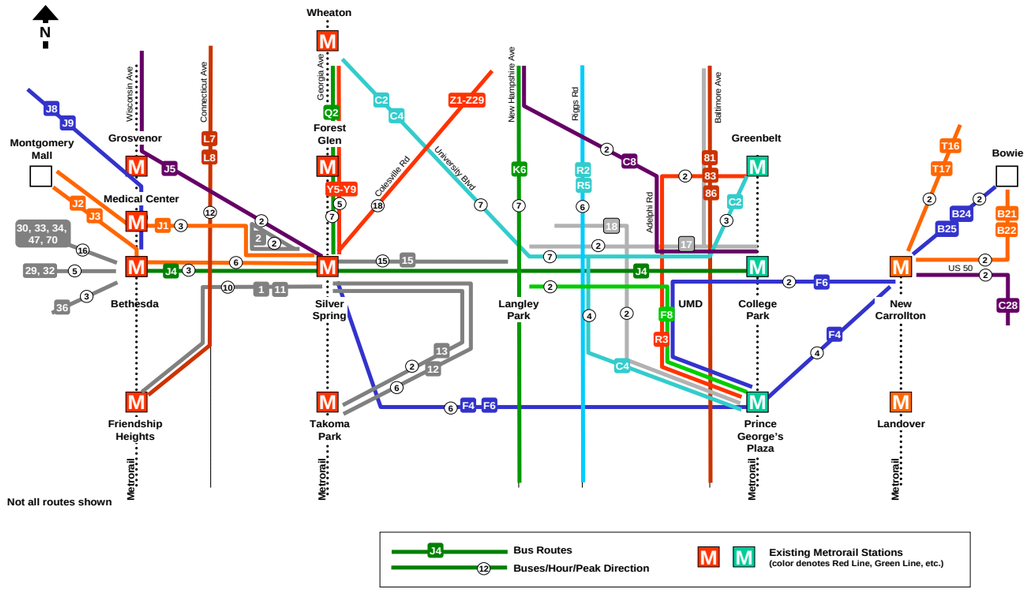


Table 2-1: Existing East-West Transit Service

Route	Terminal and Intermediate Points	Headways (minutes)					
		Early Morning	AM Peak	Midday	PM Peak	Evening	Weekend
J1, J2, J3	Montgomery Mall – Bethesda - Silver Spring	10	6	20	7	30	20
J4	Bethesda Metro – Silver Spring – College Park Metro	--	20	--	20	--	--
C2	Wheaton Metro – Greenbelt Metro	--	20	30	16	--	24
C4	Twinbrook Metro – Prince George's Plaza Metro	10	15	30	16	30	24
F4	Silver Spring – New Carrollton	12	12	40	15	--	30
F6	Silver Spring – New Carrollton	--	20	40	30	--	--
Ride On 15	Silver Spring Metro – Langley Park	15	4	12	4	30	12
TheBus 17	Langley Park–UM–College Park Metro	45	45	45	45	--	--
UM Shuttle 111	UM – Silver Spring Metro	--	35	75	45	30	--
UM Shuttle 104	UM – College Park Metro	8	8	12	8	20	20

and small physical improvements, plus selected roadway upgrades through intersection improvements, minor widenings, and other focused traffic engineering actions. A TSM alternative normally includes such features as bus route restructuring, more frequent bus service, expanded use of articulated buses to reduce crowding for passengers, bus lanes, special bus ramps on freeways, expanded park-and-ride facilities, express and limited-stop service, signalization improvements, and improved transfer operations. While the scale of these improvements is generally modest, TSM alternatives may cost tens of millions of dollars while guideway alternatives range up to several hundreds of millions or billions of dollars.

TSM alternatives are important components of transit studies because they provide a baseline against which all major investment alternatives are evaluated for the FTA's New Starts program. The most cost-effective TSM alternative generally serves as the baseline against which the selected Build alternative is compared during the New Starts rating and evaluation process. This process begins when the MTA applies for permission to initiate preliminary engineering and continues through final design.

The TSM service would provide faster one-seat rides between major activity centers, including Medical Center Metro Station, Bethesda Metro Station, Silver Spring Metro Station, Takoma Park, Langley Park, University of Maryland, College Park Metro Station and New Carrollton Metro Station. This route would also serve transfers to bus routes operating on radial streets, including those on Wisconsin Avenue, Connecticut Avenue, Colesville Road, Georgia Avenue, New Hampshire Avenue, Riggs Road, US 1, and Annapolis Road. It would serve the long-haul trips now carried by WMATA J2/J3, Ride On 15, and to WMATA C2/C4; and is estimated would serve nearly 80 percent of the passengers now boarding those existing routes along this corridor.

The TSM alternative would include improved bus service in the Purple Line corridor and a new through-route from Bethesda to New Carrollton replacing the existing J4 route and overlaying service on portions of the F4/F6 routes between College Park and New Carrollton. A combination of limited stop, and selected intersection and signal improvement strategies would be the core of service improvements. Sixty-foot articulated buses would be used.

The TSM service would operate as single route between Bethesda and New Carrollton generally following the routing of the Purple Line Build alternatives to provide comparable coverage for the intended markets, see Table 2-3. From Bethesda, the TSM route would operate along East West Highway (Montgomery Avenue eastbound between Woodmont and East West Highway) and Colesville Road to the Silver Spring Transit Center, then follow Wayne Avenue, Flower Avenue, and Piney Branch Road to University Boulevard. From there, the TSM route would operate along University Boulevard until the University of Maryland campus, following Campus Drive through campus and continuing on Paint Branch Parkway to the College Park Metro Station. After serving the station, the TSM route would continue on River Road, Kenilworth Avenue, East West Highway, Riverdale Road, Veterans Parkway, and Harkins Road to the west side of the New Carrollton Metro Station. Westbound the TSM route would follow Harkins Road to Annapolis Road back to Veterans Parkway and continue in the reverse order of the eastbound route described above.

As a limited-stop service, TSM bus stops would be located, west to east, at the Bethesda Metro Station, Connecticut Avenue, Grubb Road, Silver Spring Transit Center, Fenton Street, Dale Drive, Manchester Place, Arliss Street, Gilbert Street, Takoma/Langley Transit Center at New Hampshire Ave, Riggs Road, Adelphi Road, University of Maryland campus on Campus Drive, US 1, College Park Metro Station, River Road, Riverdale Park, Riverdale Road, Annapolis Road, and New Carrollton Metro Station. Each stop would be enhanced with upgraded amenities including new and enlarged shelters, concrete pads meeting ADA requirements, bus and local information, and Next Bus information. The concept is to provide a branded, easily identifiable set of bus routes and bus stops for the enhanced service and to improve those selected bus stops to best serve the passengers using the service. A map with proposed TSM stop locations is shown in Figure 2-2.

TSM Service Plan

The TSM service is envisioned to be six-minute peak and ten-minute off-peak throughout the corridor (Table 2-2). With six-minute headways and 15 percent vehicle spares, 68 vehicles would be required to operate the TSM service.

Hours of Operation and Headways

Because of the importance of the serving trips that interface with the Metrorail services intersecting the Purple Line corridor, the TSM span of service would match the Metrorail span of service. The Metrorail system opens at 5 AM on weekdays and 7 AM on weekends. It operates until midnight Sunday through Thursday and until 3 AM on Fridays and Saturdays. The fare structure for the TSM service would be the same

Figure 2-2: TSM Transit Service

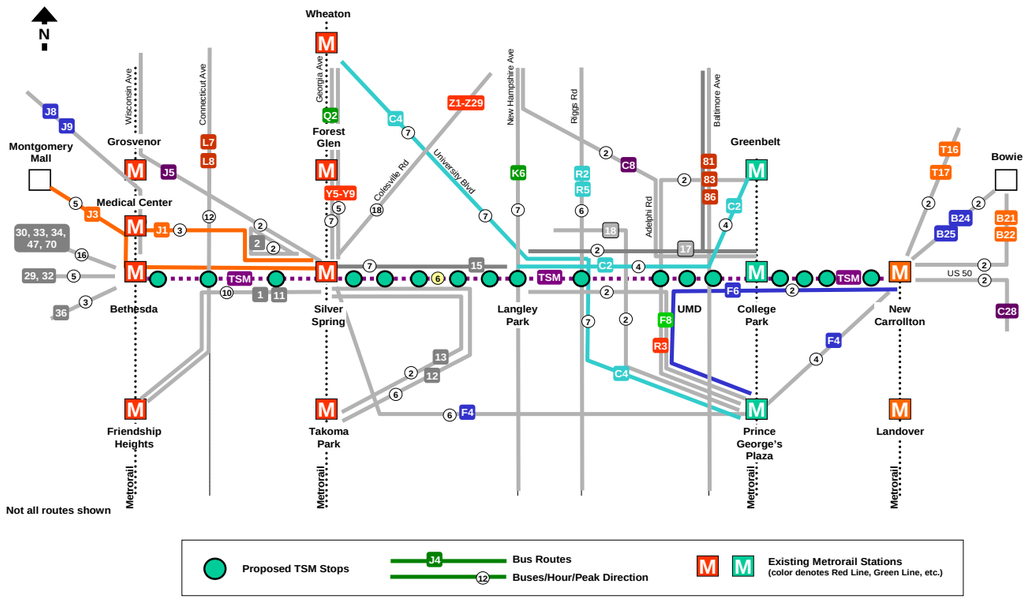


Table 2-2: TSM Bus Headways

Route	Terminal and Intermediate Points	Headways (minutes)					
		Early Morning	AM Peak	Midday	PM Peak	Evening	Weekend
TSM	Bethesda – New Carrollton	10	6	10	6	10	10
J1	Medical Center – Silver Spring	--	20	--	20	--	--
J3	Eliminate; replace with Ride On 15 service	--	--	--	--	--	--
C2	*Terminate at Langley Park* Langley Park – Greenbelt	30	15	20	15	30	30
C4	Twinbrook Metro – Prince George's Plaza Metro	10	8	15	8	20	20
F4	Silver Spring – New Carrollton	12	10	30	10		30
F6	*Terminate at Prince George's Plaza* Prince George's Plaza – New Carrollton	--	15	30	15	--	--
Ride On 15	Bethesda – Langley Park *(extend to Bethesda)*	15	15	15	15	30	15
TheBus 17	Langley Park–UM–College Park Metro	45	45	45	45	--	--

as under the No Build alternative, recognizing that fares would increase over time. SmartCard, or some other means of electronic fare collection, may enable an integrated fare structure and convenient transfer with other transit services in the corridors.

Transit Travel Times

End-to-end, the TSM route is 16 miles long, requiring about 108 minutes of running time with an average round trip speed of 9 miles per hour. Today, the bus routes along the alignment, J4, F4, and F6, operate in very difficult circumstances with a wide range of times in each direction and between the AM and PM. Anecdotal reports from WMATA indicate that the J4 route may require 50 percent more time than scheduled on certain runs to complete its trip. These conditions complicate schedule preparation and operations planning. It is assumed TSM measures would somewhat mitigate these conditions; however, 2030 projected traffic volumes and traffic congestion levels will be far greater than they are today.

There is only limited opportunity for improving transit service travel times and reliability using signal preference strategies along the Purple Line corridor. The major radial roadways that cross the corridor, such as Rockville Pike, Connecticut Avenue, Georgia Avenue, New Hampshire Avenue, Kenilworth Avenue, and US 1, are the major sources of delay at intersections. These roadways carry very heavy traffic flows into and out of the District of Columbia and other major activity centers. There is very little opportunity to introduce signal preferences at these intersections without causing major exacerbation of traffic conditions. Queue jump lanes, however, do provide a travel time advantage enabling transit vehicles to get to the intersection and limit the delay to one or two traffic signal cycles.

Transit service to the Bethesda Naval Hospital/National Institutes of Health area would be provided from Silver Spring and points east through the enhanced J1 service with queue jump lanes and operational or service modifications. The Metrorail Red Line Medical Center Station would continue to provide connectivity to the entire rail-bus network.

2.4.3. Build Alternatives

The following section describes various alignments at low, medium, and high levels of investment. Several design options (e.g., tunnel segments, aerial, and at-grade alternative horizontal alignments) would serve the same market.

All alternatives would extend the full length between the Bethesda Metro Station in the western portion of the corridor and the New Carrollton Metro Station in the east, with variations in alignment location, type of running way (shared, dedicated, or exclusive), and amount of grade separation. The decision whether to construct dedicated lanes depends on the ability of the service to operate reasonably well without dedication, and on the cost, in dollars or impacts.

Each alternative is identified by the level of investment. A matrix summarizing the BRT alternatives is presented in Table 2-3 and a matrix summarizing the LRT Alternatives is presented in Table 2-4.

While six end-to-end alternatives have been defined and evaluated for the project, the Locally Preferred Alternative could be composed of an assortment of segments from alternatives at different levels of investment.

All alternatives would include incorporation of signal priority and/or queue jump lanes at major intersections where feasible, if the analysis demonstrates that such priority provides significant time savings or reliability.

It should be noted that all alignments that would use the Georgetown Branch right-of-way (the Master Plan alignment) include construction of a parallel multi-use trail within the Georgetown Branch right-of-way.

Hiker Biker Trail

All the alignments except the Low Investment BRT would include construction of a permanent trail facility alongside the transitway between Bethesda and the Silver Spring Transit Center. This trail would be built following Montgomery County standards for trail design; a 10-foot-wide paved trail with 2-foot shoulders. Between Pearl Street and just west of Jones Mill Road the trail would be on the north side of the transitway; elsewhere it would be on the south side. Access to the trail would be provided at various points along the way, as would crossings over the transitway. The MTA has set a goal of maintaining a landscaped buffer of approximately 10 feet between the trail and the transitway and, wherever possible, the trail would be built at a slightly higher elevation than the transitway. A barrier, either a fence or a wall, would separate the trail and transitway. All alignments, including the Low Investment BRT, include construction of the trail from Jones Mill Road to the Silver Spring Transit Center. The trail would cross the CSX right-of-way on a new pedestrian bridge east of the existing Talbot Avenue bridge. After crossing the CSX right-of-way the trail would continue on the north side to the Silver Spring Transit Center.

Table 2-3: Summary of BRT Alternatives

	Bethesda / Chevy Chase			Silver Spring			
TSM Alternative	The TSM goes from the Bethesda Metro Station (north entrance)out to Woodmont Avenue to Montgomery Lane to East West Highway.		The TSM would operate in mixed traffic, with signal priority treatments implemented where possible to increase schedule adherence. Westbound buses could use existing right-turn lanes to bypass queuing at Jones Mill Road and 16th Street.	At Colesville Road, the TSM would turn left and then right onto Wayne Avenue and right onto Ramsey Street to access the Silver Spring Transit Center. The TSM would operate in mixed traffic with signal priority, where possible.		The buses would exit the SSTC along Ramsey Street, and follow Wayne Avenue in shared lanes to Flower Street. Buses turn right onto Flower Street, operating in shared lanes until Piney Branch Road. Signal priority would be provided, where possible.	
BRT							
Alternative 3: Low Investment BRT	The transitway goes from the Bethesda Metro Station (north entrance) up Woodmont Avenue to Jones Bridge Road.	On Jones Bridge Road the buses are in shared lanes with queue jump lanes at key intersections.	At Jones Mill Road the transitway joins the Georgetown Branch right-of-way. A permanent trail will be constructed along the south side of the transitway. There will be two new bridges over Rock Creek, one for the transitway, one for the trail.	At the CSX corridor the transitway stays on the south side of the CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets at grade.	Transitway crosses CSX at Spring Street and continues on Second Avenue. Buses enter Silver Spring Transit Center from Ramsey Street.	The buses continue up Wayne Avenue in shared lanes, to Flower Avenue, then Arliss Street.	
Alternative 4: Medium Investment BRT	The transitway begins with a one-way counter clockwise loop on Pearl St, East West Highway, Old Georgetown Road, with a stop at the Bethesda Metro Station (north entrance) Edgemoor Lane, Woodmont Avenue on to Georgetown Branch right-of-way alignment. Under the Air Rights Building, there is a direct elevator connection to the Bethesda Metro Station (south entrance). The trail is on the north side of transitway from Pearl Street east.		The transitway follows the Georgetown Branch right-of-way. There will be two bridges over Connecticut Avenue, one for the transitway, and one for the trail, as well as two new bridges over Rock Creek. The transitway and trail go under Jones Mill Road. Just west of Jones Mill Road the trail crosses to the south side of the transitway.	At the CSX corridor the transitway stays on the south side of CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets at grade.	East of Falklands Apartments the transitway crosses over CSX tracks, to arrive at the Silver Spring Transit Center.	The buses leave the CSX right-of way on Bonifant Street at grade in dedicated lanes.	Wayne Avenue in shared lanes with added left turn lanes, to Flower Avenue, then Arliss Street.
Alternative 5: High Investment BRT	The transitway begins with a one-way counter clockwise loop on Pearl St, East West Highway, Old Georgetown Road, with a stop at the Bethesda Metro Station (north entrance) Edgemoor Lane, and Woodmont Avenue on to Georgetown Branch right-of-way. Under the Air Rights Building, there is a direct elevator connection to the Bethesda Metro Station (south entrance). The trail is on the north side of transitway from Pearl Street east.		The transitway follows the Georgetown Branch right-of-way. There will be two bridges over Connecticut Avenue, one for the transitway, and one for the trail, as well as two new bridges over Rock Creek. The transitway and trail go under Jones Mill Road. Just west of Jones Mill Road the trail crosses to the south side of the transitway.	At the CSX corridor the transitway stays on the south side of CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets below the grade of those streets.	East of Falklands Apartments the transitway crosses over CSX tracks, to arrive at the Silver Spring Transit Center.	Tunnel from Silver Spring Transit Center to Wayne Avenue at Cedar Street	Wayne Avenue at grade in dedicated lanes, with a tunnel under Plymouth to Arliss Street.
					(Design option) Aerial crossing of CSX west of Falklands Apartments with an aerial structure along Metro Plaza.	(Design option) Silver Spring/ Thayer Avenue tunnel that emerges on Thayer Avenue behind East Silver Spring Elementary School.	
				(Design option) The transitway crosses to the north side of the CSX corridor in a tunnel and continues along the north side.			

Table 2-3: Summary of BRT Alternatives (continued)

University Boulevard		UM / College Park		Riverdale Park			New Carrollton			
The TSM service turns left on Piney Branch Road and then right on University Boulevard, both in shared lanes. Signal priority would be provided, where possible. Eastbound and westbound buses could use the existing right-turn lanes / shoulder (where available) to bypass queuing.		The buses pass through the University of Maryland campus on Campus Drive and cross US 1 at Paint Branch Parkway. Signal priority would be provided where possible. Westbound buses could utilize the existing right-turn lane at Paint Branch Parkway and US 1 to bypass queuing.		The TSM service follows Paint Branch Parkway and River Road in shared lanes. The buses turn right on Kenilworth Avenue in shared lanes. The buses then turn left onto East West Highway into shared lanes. Buses could utilize existing right turn lanes at MD 410 / MD 295 ramp terminals to bypass queuing. Signal priority would be provided where possible.			TSM service continues onto Veterans Parkway in shared lanes. Westbound buses could use the existing right turn along Veterans Parkway at Riverdale Road to bypass queuing.	TSM service turns left on to Annapolis Road into shared lanes.	The TSM services reach the New Carrollton Station via Harkins Road in shared lanes to arrive at the New Carrollton Metro Station.	**TSM Alternative**
										BRT
The transitway turns left on Piney Branch Road and then right on University Boulevard, both in shared lanes.		The buses pass through the University of Maryland campus on Campus Drive and cross US 1 at Paint Branch Parkway.		The transitway follows Paint Branch Parkway and River Road in shared lanes. The buses enter the College Park Metro Station at the bus loop continuing on River Road in shared lanes.	The buses turn right on Kenilworth Avenue, southbound buses in a dedicated lane, northbound in shared lanes.	The buses turn left at East West Highway into shared lanes.	They continue on Veterans Parkway in shared lanes.	Turning left on Annapolis Road, the buses are in a dedicated lane westbound, and shared lanes eastbound.	The buses turn on to Harkins Road in shared lanes to arrive at the New Carrollton Metro Station.	**Alternative 3: Low Investment BRT**
The transitway turns left on Piney Branch Road and continues in dedicated lanes.	The buses turn right on University Boulevard, in dedicated lanes. All intersections are crossed at grade	The buses pass through the University of Maryland campus in dedicated lanes on Campus Drive.	At Regents Drive (the "M") the buses travel at grade in a new exclusive transitway through the parking lots adjacent to the Armory. At East Campus, the alignment crosses US 1 at grade on Rossborough Lane.	The transitway follows Paint Branch Parkway in shared lanes and enters the College Park Metro Station at the bus loop continuing on River Road in shared lanes.	The buses turn right on Kenilworth Avenue, both directions in dedicated lanes on the west side on the roadway.	The buses turn left at East West Highway in dedicated lanes.	Veterans Parkway in shared lanes. The crossing of Annapolis Road is at grade.	The buses turn left on to Ellin Road into dedicated lanes to arrive at the New Carrollton Metro Station.		**Alternative 4: Medium Investment BRT**
		(Design Option) Campus Drive to Preinkert Drive where the alignment turns south east and continues on new alignment between LeFrak Hall and the South Campus Dining Hall. The alignment continues east on Chapel Drive then on a new alignment to Rossborough Lane where it crosses US 1 at grade.								
The transitway turns left on Piney Branch Road and continues in dedicated lanes.	The buses turn right on University Boulevard in dedicated lanes, with bridges over key intersections, and an underpass at Adelphi Road.	The buses go through the University of Maryland campus in a tunnel under Campus Drive, emerging just past the "M" at Regents Drive	At Regents Drive (the "M") the buses travel at grade in a new exclusive transitway through the parking lots adjacent to the Armory. At East Campus, the alignment crosses US 1 at grade on Rossborough Lane.	The transitway follows Paint Branch Parkway in dedicated lanes until the CSX underpass. It turns right at the College Park Metro parking garage passing through the new station development and along the south side of River Road, in dedicated lanes.	The buses enter a tunnel from River Road to East West Highway at Kenilworth Road.	The buses follow East West Highway at grade in dedicated lanes.	On Veterans Parkway the transitway is in dedicated lanes with an underpass at Annapolis Road.	The buses turn left on to Ellin Road into dedicated lanes to arrive at the New Carrollton Metro Station.		**Alternative 5: High Investment BRT**

Table 2-4: Summary of LRT Alternatives

	Bethesda / Chevy Chase		Silver Spring				University Boulevard	
LRT								
Alternative 6: Low Investment LRT	The alignment follows the Georgetown Branch right-of-way. The alignment starts under the Air Rights Building with a direct elevator connection to the Bethesda Metro Station (south entrance). The trail does not go under the Air Rights Building, but off the alignment through Elm Street Park. The trail is on north side of the transitway from Pearl Street east.	The transitway follows the Georgetown Branch right-of-way. The LRT and the trail cross Connecticut Avenue at grade. There would be two new bridges over Rock Creek, one for the transitway, and one for the trail. The transitway and trail go under Jones Mill Road. Just west of Jones Mill Road the trail crosses to the south side of the transitway.	At the CSX corridor the transitway stays on south side of CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets at grade.	East of Falklands Apartments the transitway crosses over CSX tracks, to arrive at the Silver Spring Transit Center.	The LRT leaves the CSX right-of way on Bonifant Street at grade in dedicated lanes.	It travels on Wayne Avenue in shared lanes, entering a tunnel after Manchester Place and continuing under Plymouth to emerge on Arliss Street.	The transitway turns left on Piney Branch Road and continues in dedicated lanes.	The LRT turns right on University Boulevard, in dedicated lanes. All intersections are crossed at grade, except there is an underpass at Adelphi Road.
Alternative 7: Medium Investment LRT	The alignment follows the Georgetown Branch right-of-way. The alignment starts under the Air Rights Building with a direct elevator connection to the Bethesda Metro Station (south entrance). The trail does not go under the Air Rights Building, but off the alignment through Elm Street Park. The trail is on north side of the transitway from Pearl Street east.	The transitway follows the Georgetown Branch right-of-way. There will be two bridges over Connecticut Avenue, one for the transitway, and one for the trail, as well as two new bridges over Rock Creek. The transitway and trail go under Jones Mill Road. Just west of Jones Mill Road the trail crosses to the south side of the transitway.	At the CSX corridor the transitway stays on south side of CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets below the grade of those streets.	East of Falklands Apartments the transitway crosses over CSX tracks, to arrive at the Silver Spring Transit Center.	The LRT leaves the CSX right-of way on Bonifant Street at grade in dedicated lanes.	Wayne Avenue in shared lanes with added left turn lanes, entering a tunnel after Manchester Place and continuing under Plymouth to emerge on Arliss Street.	The transitway turns left on Piney Branch Road and continues in dedicated lanes.	The LRT turns right on University Boulevard, in dedicated lanes. All intersections are crossed at grade except there is an underpass at Adelphi Road.
Alternative 8: High Investment LRT	This alignment starts under the Air Rights Building with a direct elevator connection to the Bethesda Metro Station (south entrance). Under the Air Rights Building the trail is in the tunnel, elevated above eastbound tracks. The trail is on the north side of the tracks between Pearl Street and just west of Jones Mill Road.	The transitway follows the Georgetown Branch right-of-way. There will be two bridges over Connecticut Avenue, one for the transitway, and one for the trail, as well as two new bridges over Rock Creek,. The transitway and trail go under Jones Mill Road. Just west of Jones Mill Road the trail crosses to the south side of the transitway.	At the CSX corridor the transitway stays on south side of CSX corridor, while the trail crosses CSX on a new bridge near Talbot Street Bridge. The transitway crosses 16th and Spring Streets below the grade of those streets.	East of Falklands Apartments the LRT crosses over CSX tracks, to arrive at the Silver Spring Transit Center.	Tunnel from SSTC to Wayne Avenue at Cedar Street	Wayne Avenue at grade in dedicated lanes, with a tunnel under Plymouth to Arliss Street.	The transitway turns left on Piney Branch Road and continues in dedicated lanes.	The trains turn right on University Boulevard in dedicated lanes, with bridges over key intersections, and an underpass at Adelphi Road.
			(Design option) Aerial crossing of CSX west of Falklands Apartments with an aerial structure along Metro Plaza.	(Design option) Silver Spring/ Thayer Avenue tunnel that emerges on Thayer Avenue behind East Silver Spring Elementary School, but with an aerial structure on a portion of Piney Branch Road.				
			(Design option) The transitway crosses to the north side of the CSX corridor in a tunnel and continues along the north side.					

Table 2-4: Summary of LRT Alternatives (Continued)

UM / College Park			Riverdale Park			New Carrollton			
									LRT
The trains pass through the University of Maryland campus in dedicated lanes on Campus Drive.	At Regents Drive (the "M") the LRT travels at grade in a new exclusive transitway through the parking lots adjacent to the Armory. At East Campus, the alignment crosses US 1 at grade on Rossborough Lane.	The LRT uses Paint Branch Parkway in shared lanes.	LRT turns right at the College Park Metro parking garage passing through the new station development and along the south side of River Road, in dedicated lanes.	The LRT turns right at Kenilworth Avenue into dedicated lanes (both directions).	The LRT follows East West Highway at grade in dedicated lanes with shared left turn lanes. Shared under BW Parkway.	On Veterans Parkway the transitway is in dedicated lanes.	Turning left on Annapolis Road, the LRT is in dedicated lanes on the south/east side of the roadway.	Turning right on Harkins Road, the LRT is in dedicated lanes on the south side of the roadway to arrive at the New Carrollton.	**Alternative 6: Low Investment LRT**
The trains pass through the University of Maryland campus in dedicated lanes on Campus Drive.	At Regents Drive (the "M") the LRT travels at grade in a new exclusive transitway through the parking lots adjacent to the Armory. At East Campus, the alignment crosses US 1 at grade on Rossborough Lane.	The LRT uses Paint Branch Parkway in shared lanes.	LRT turns right at the College Park Metro parking garage passing through the new station development and along the south side of River Road, in dedicated lanes.	The LRT turns right at Kenilworth Avenue into dedicated lanes (both directions).	The LRT follows East West Highway at grade in dedicated lanes with shared left turn lanes. Shared under BW Parkway	On Veterans Parkway in dedicated lanes. The crossing of Annapolis Road is at grade.	The LRT turns left on to Ellin Road into dedicated lanes on the southeast side of the roadway to arrive at the New Carrollton Metro Station.		**Alternative 7: Medium Investment LRT**
(Design Option) Campus Drive to Preinkert Drive where the LRT turns south east and continues on a new alignment between LeFrak Hall and South Campus Dining Hall. The LRT continues east on Chapel Drive then on a new alignment to Rossborough Lane and it crosses US 1 at grade.									
The trains go through the University of Maryland campus in a tunnel under Campus Drive, emerging just past the "M" at Regents Drive.	At Regents Drive (the "M") the LRT travels at grade in a new exclusive transitway through the parking lots adjacent to the Armory. At East Campus, the alignment crosses US 1 at grade on Rossborough Lane.	The LRT uses Paint Branch Parkway in dedicated lanes until the CSX/ Metro underpass at College Park.	LRT turns right at the College Park Metro parking garage passing through the new station development and along the south side of River Road, in dedicated lanes.	The transitway enters a tunnel from River Road to East West Highway at Kenilworth Road.	The LRT follows East West Highway at grade in dedicated lanes in the median.	On Veterans Parkway the transitway is in dedicated lanes with an underpass at Annapolis Road.	The LRT turns left on to Ellin Road into dedicated lanes on the southeast side of the roadway to arrive at the New Carrollton Metro Station.		**Alternative 8: High Investment LRT**

2.4.4. Alternative 3 – Low Investment BRT

Low Investment BRT would primarily use existing streets to avoid the cost of grade separation and extensive reconstruction of existing streets. It would incorporate signal, signage, and lane improvements in certain places. This alternative would operate mostly in mixed lanes with at-grade crossings of all intersections and queue jump lanes at some intersections. Southbound along Kenilworth Avenue and westbound along Annapolis Road, Low Investment BRT would operate in dedicated lanes. This is the only alternative that would operate on Jones Bridge Road, directly serving the National Institutes of Health and the National Naval Medical Center near Wisconsin Avenue and Jones Bridge Road. It is also the only alternative that would use the bus portion of the new Silver Spring Transit Center. A detailed description of the alternative follows.

From the western terminus in Bethesda, Low Investment BRT would originate at the Bethesda Metro Station bus terminal. The alignment would operate on Woodmont Avenue within the existing curb. At the Bethesda Station, the buses would enter the station via Edgemoor Road and exit onto Old Georgetown Road.

At Wisconsin Avenue, just south of Jones Bridge Road, the transitway would remain on the west side of the road in exclusive lanes. Low Investment BRT would turn onto Jones Bridge Road where the transit would operate in shared lanes with queue jump lanes westbound at the intersection with Wisconsin Avenue and westbound for the intersection at Connecticut Avenue. Some widening would be required at North Chevy Chase Elementary School.

The alignment would continue along Jones Bridge Road to Jones Mill Road where it would turn right (south) onto Jones Mill Road. Eastbound on Jones Bridge Road would be a queue jump lane at the intersection. From Jones Mill Road the alignment would turn east onto the Georgetown Branch right-of-way, where a new exclusive roadway would be constructed, with an adjacent trail on the south side.

Low Investment BRT would continue on the Georgetown Branch right-of-way, crossing Rock Creek Park on a new bridge, replacing the existing pedestrian bridge. The trail would be on an adjacent bridge. A trail connection to the Rock Creek Trail would be provided east of the bridge. The alignment would continue on the Georgetown Branch right-of-way until the CSX corridor at approximately Kansas Avenue.

At this point the alignment would turn southeast to run parallel and immediately adjacent to the CSX tracks on a new exclusive right-of-way. The trail would parallel the transitway, crossing the transitway and the CSX right-of-way east of Talbot Avenue on a new structure and continuing on the north side of the CSX right-of-way. The transitway would continue on a new roadway between the CSX tracks and Rosemary Hills Elementary School, and continue past the school. The transitway would cross 16th Street at grade, where a station would be located. The transitway would continue parallel to the CSX tracks to Spring Street, at which point it would connect to Spring Street and turn to cross over the CSX tracks on Spring Street. The alignment would continue on Spring Street to 2nd Avenue where it would turn east. BRT would operate in shared lanes on Spring Street and Second Avenue.

Low Investment BRT would cross Colesville Road at grade and continue up Wayne Avenue to Ramsey Street, where the BRT would turn right to enter the Silver Spring Transit Center at the second level.

The BRT would leave the Silver Spring Transit Center and return to Wayne Avenue via Ramsey Street. Low Investment BRT would continue east on Wayne Avenue in shared lanes. After crossing Sligo Creek Parkway, the alignment would operate in shared lanes.

At Flower Avenue, the alignment would turn south to Arliss Street, where it would turn left onto Arliss Street, operating in shared lanes to Piney Branch Road. At Piney Branch Road the alignment would turn left to continue in shared lanes to University Boulevard.

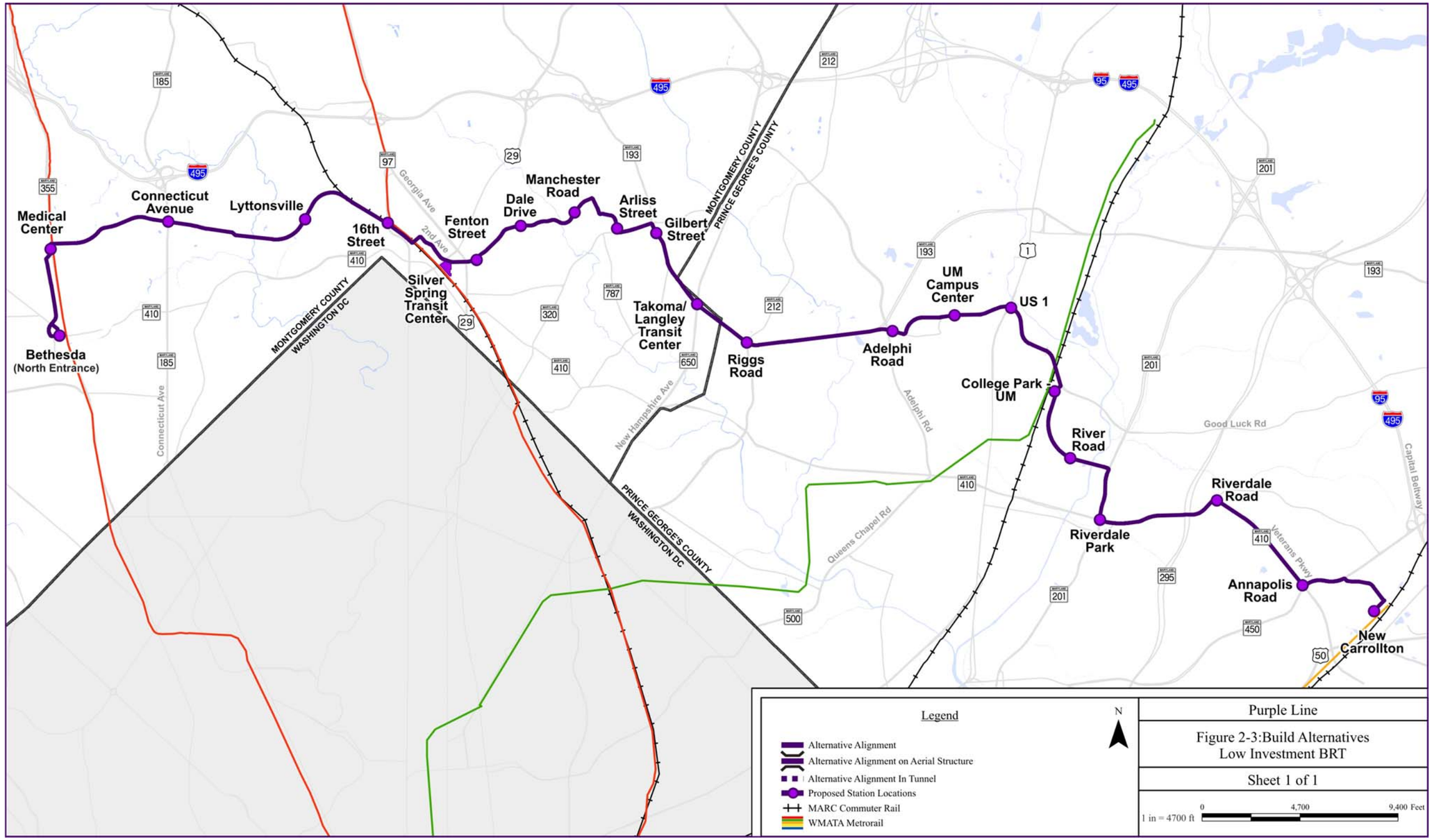
Low Investment BRT would follow University Boulevard to Adelphi Road. The lanes on University Boulevard would be shared. At Adelphi Road the alignment would enter the University of Maryland campus on Campus Drive. The alignment would follow the Union Drive extension, as shown in the University of Maryland Facilities Master Plan (2001-2020), through what are currently parking lots. The alignment would follow Union Drive and then Campus Drive through campus in shared lanes, and through the main gate to US 1.

Low Investment BRT would operate on Paint Branch Parkway to the College Park Metro Station in shared lanes. The buses would enter the College Park Metro station bus loop from River Road. The alignment would then follow River Road to Kenilworth Avenue in shared lanes. Along Kenilworth Avenue the southbound alignment would be a dedicated lane, but northbound would be in shared lanes.

The alignment would turn east from Kenilworth Avenue on MD 410 and continue in shared lanes on Veterans Parkway. This alignment would then turn left on Annapolis Road and then right on Harkins Road to the New Carrollton Metro Station. Westbound on Annapolis Road the BRT would operate dedicated lanes, but eastbound it would operate in shared lanes.

University Boulevard with BRT in Shared Lanes

Figure 2-3: Alternative 3 - Low Investment BRT



2.4.5. Alternative 4 – Medium Investment BRT

The Medium Investment BRT is, by definition, an alternative that uses the various options that provide maximum benefit relative to cost. Most of the segments are selected from either the Low or High Investment BRT Alternatives.

This alternative follows a one-way counter-clockwise loop from the Georgetown Branch right-of-way onto Pearl Street, East West Highway, Old Georgetown Road, Edgemoor Lane, and Woodmont Avenue and from there onto the Georgetown Branch right-of-way under the Air Rights Building. The BRT stops twice at the Bethesda Metro station, once at the existing bus loop on Edgemoor Lane and again at the new southern entrance to the Metro Station under the Air Rights Building.

The alignment continues on the Georgetown Branch right-of-way with an aerial crossing over Connecticut Avenue and a crossing under Jones Mill Road.

This alignment, and all others that use the Georgetown Branch right-of-way, includes construction of a hiker-biker trail between Bethesda and the Silver Spring Transit Center.

The alignment would continue on the Georgetown Branch right-of-way until the CSX right-of-way. The alignment would cross Rock Creek Park on a new bridge, replacing the existing pedestrian bridge. The trail would be an adjacent bridge. The alignment would continue on the Georgetown Branch right-of-way until the CSX corridor at approximately Kansas Avenue. This segment of the alignment, from Jones Mill Road to the CSX corridor, would be the same for all the alternatives.

Like Low Investment BRT, this alternative would follow the CSX corridor on the south side of the right-of-way, but it would cross 16th Street and Spring Street at the grade of the streets, resulting in a new signalized intersections.

After crossing Spring Street, the Medium Investment BRT would rise above the level of the existing development south of the CSX right-of-way. East of the Falklands Chase apartments, Medium Investment BRT would cross over the CSX tracks on an aerial structure to enter the Silver Spring Transit Center parallel to, but at a higher level than, the existing tracks.

After the Silver Spring Transit Center, Medium Investment BRT would leave the CSX right-of-way and follow Bonifant Street at grade, crossing Georgia Avenue at grade, and just prior to Fenton Street, turn north toward Wayne Avenue. The alignment would continue on Wayne Avenue in shared lanes with added left turn lanes to Flower Avenue and then Arliss Street. At Piney Branch Road the alternative would turn left into dedicated lanes and continue on to University Boulevard.

Medium Investment BRT would be in dedicated lanes on University Boulevard with an at-grade crossing of the intersections. The alignment would continue through the University of Maryland campus in dedicated lanes on Campus Drive and then continue at grade in a new exclusive transitway through the parking lots adjacent to the Armory, behind the Visitors Center to Rossborough Lane.

Crossing US 1 at grade, this alternative would pass through the East Campus development on Rossborough Lane to Paint Branch Parkway. The alignment would continue on Paint Branch Parkway and River Road in shared lanes, as with Low Investment BRT. The buses would enter the College Park Metro Station bus loop from River Road. On Kenilworth Avenue both lanes would be dedicated.

Turning left on East West Highway, Medium Investment BRT would be in dedicated lanes. As with Low Investment BRT, this alternative would travel in shared lanes on Veterans Parkway to Ellin Road, where it would turn left into dedicated lanes to the New Carrollton Metro Station.

Wayne Avenue at Cedar Street

Medium Investment BRT Variations Serving Medical Center

The Town of Chevy Chase has raised concerns regarding the transit service provided by the Purple Line alternatives to the National Institutes of Health and the National Naval Medical Center (NNMC). With the exception of Low Investment BRT, all the alternatives provide improved bus service between Silver Spring and NNMC as well as the option to transfer to the Metro Red Line at Bethesda to reach NNMC. Low Investment BRT provides more direct service to NNMC, but less direct service to downtown Bethesda by traveling along Jones Bridge Road to the Medical Center area and then along Woodmont Avenue to Bethesda.

Because Low Investment BRT does not have the travel time benefits afforded by Medium Investment BRT west of Jones Mill Road, the Town of Chevy Chase proposed a variation of Medium Investment BRT which uses Jones Bridge Road west of Jones Mill Road, instead of using the county–owned Master Plan alignment that goes directly to Bethesda. This variation would include an additional stop at St. Elmo Street on Woodmont Avenue. (See Figure 2-5).

Another variation that would directly serve the Medical Center area would extend the service of Medium Investment BRT from the north entrance of the Bethesda Metro Station, up Woodmont to the NNMC, also including a station at St. Elmo Street. (see Figure 2-6).

Both variations provide the benefits of Medium Investment BRT east of Jones Mill Road and provide a one-seat ride to the Bethesda and NNMC. Ridership and cost summaries of these variations will be presented in Chapter 6.

Figure 2-4: Alternative 4 - Medium Investment BRT

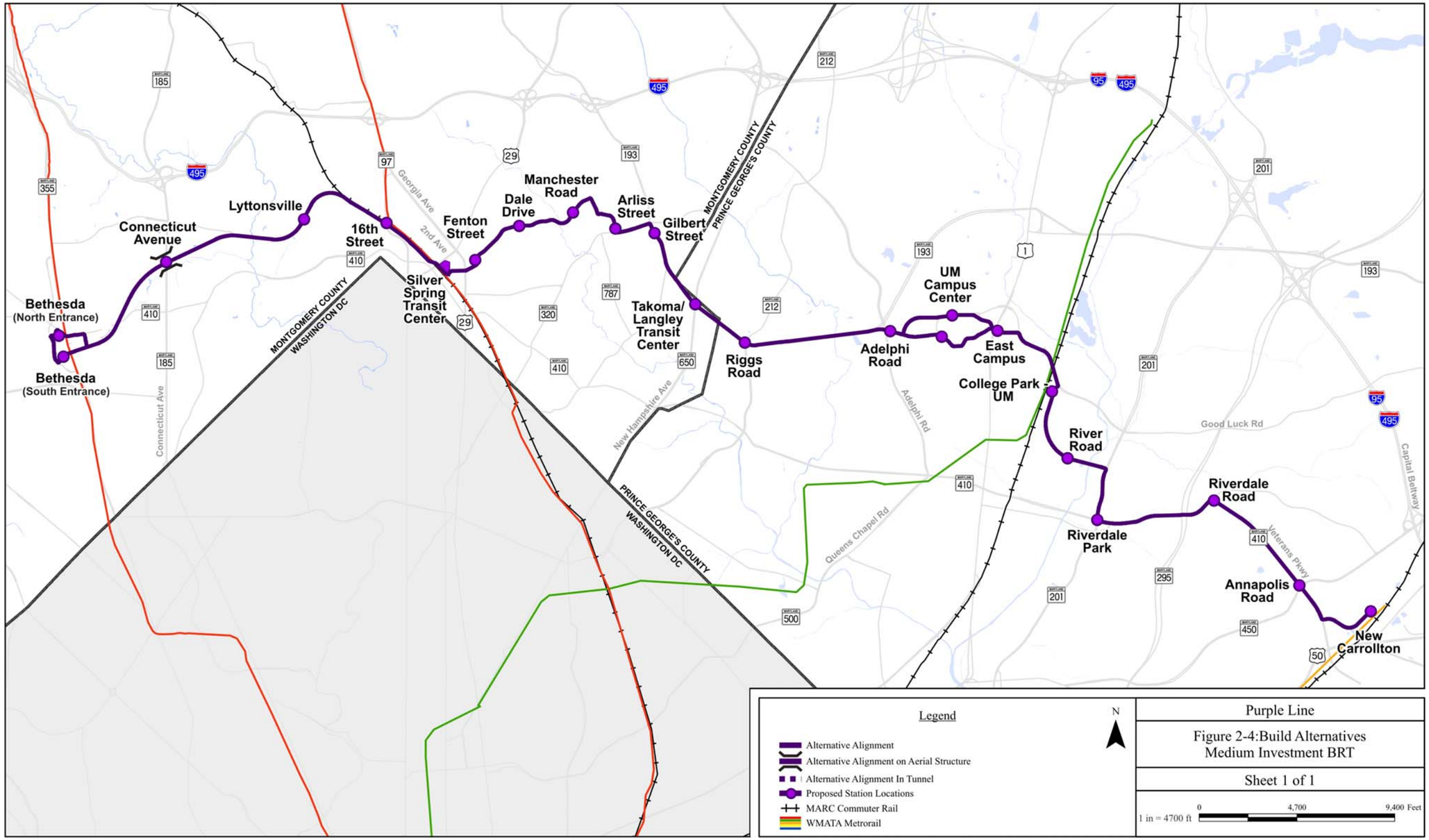


Figure 2-5: Medium Investment BRT using Jones Bridge Road

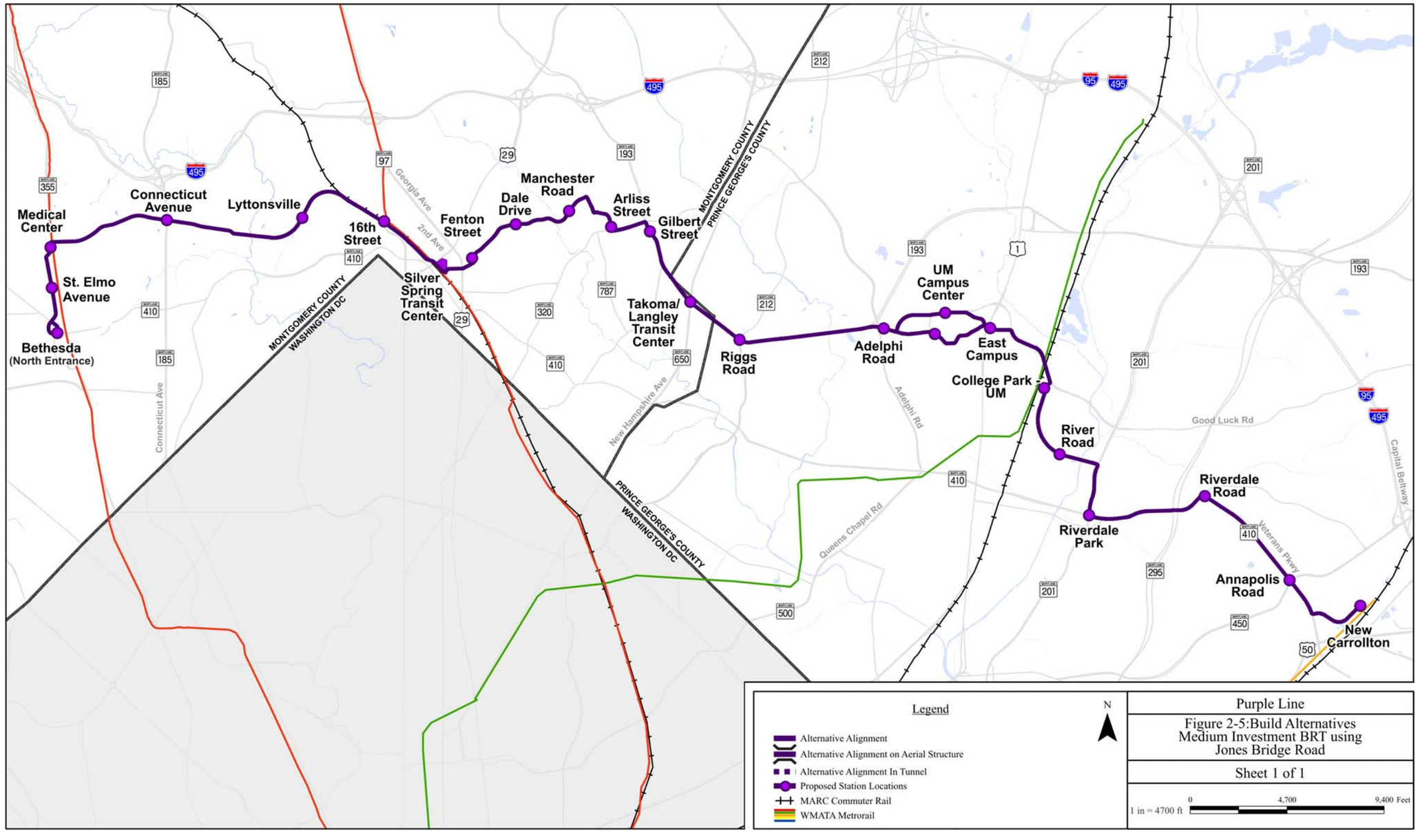
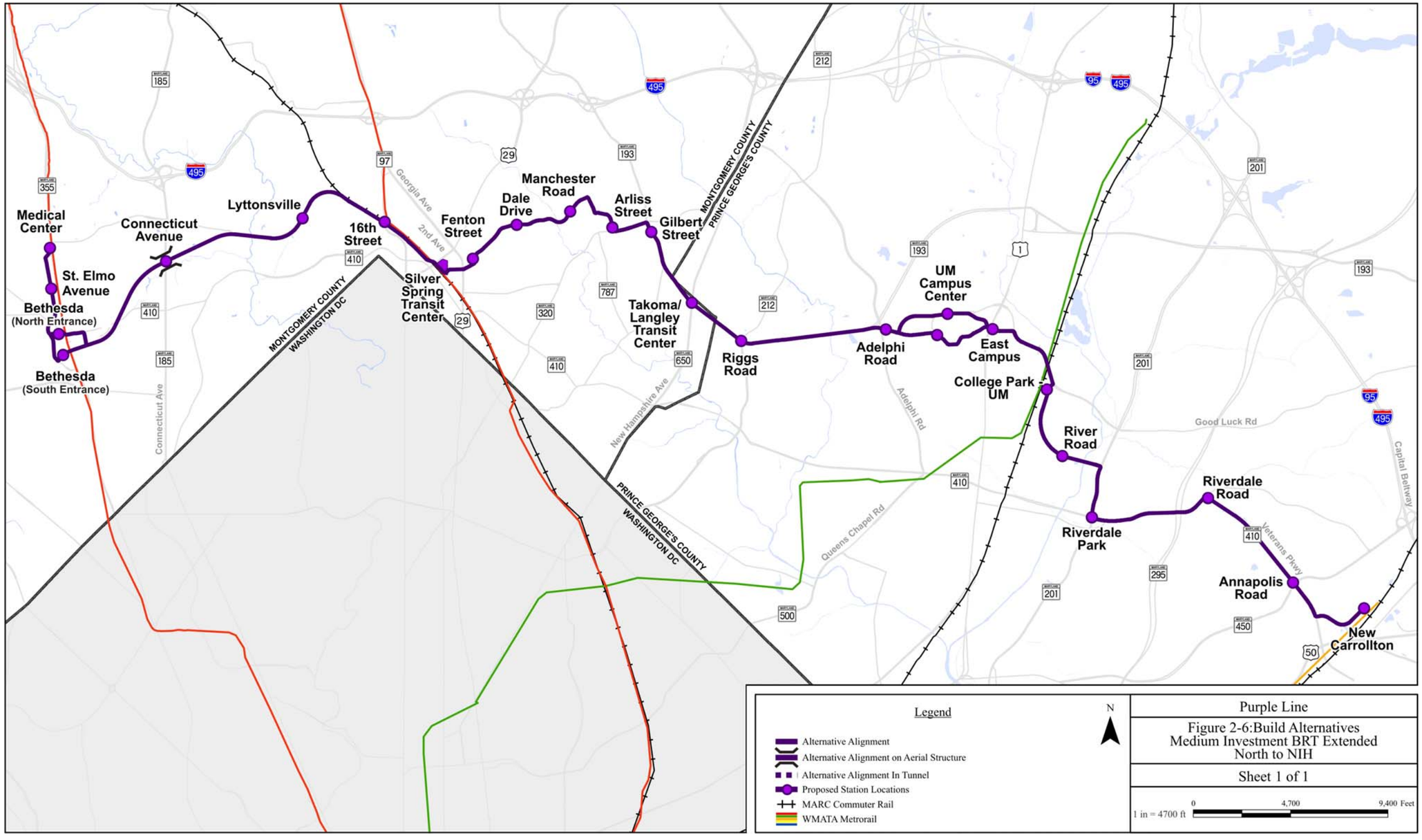


Figure 2-6: Medium Investment BRT extended north to NIH



2.4.6. Alternative 5 – High Investment BRT

High Investment BRT is intended to provide the most rapid travel time of the BRT alternatives. It would make maximum use of vertical grade separation and horizontal traffic separation. Tunnels and aerial structures are proposed at key locations to improve travel time and reduce delay. When operating within or adjacent to existing roads, this alternative would operate primarily in dedicated lanes. Like Medium Investment BRT, this alternative would serve the Bethesda Metro Station, both at the existing Bethesda bus terminal and at the new south entrance to the Metro Station beneath the Apex Building.

High Investment BRT would follow a one-way loop in Bethesda from the Master Plan alignment onto Pearl Street, then travel west on East West Highway and Old Georgetown Road into the Bethesda Metro Station bus terminal, exit onto Woodmont Avenue southbound, and then continue left under the Air Rights Building on the Georgetown Branch right-of-way. Elevators would provide a direct connection to the south end of the Bethesda Metro Station in the tunnel under the Air Rights Building.

The High Investment BRT alignment would be the same as Medium Investment BRT until it reaches the CSX corridor. As with the Low and Medium Investment BRT alternatives, this alternative would follow the CSX corridor on the south side of the right-of-way, and like Medium Investment BRT, it would cross 16th Street and Spring Street below the grade of the streets, at approximately the same grade as the CSX tracks. The station at 16th Street would have elevators and escalators to provide access from 16th Street.

The crossing of the CSX right-of-way would be the same as for Medium Investment BRT. The alignment would rise above the level of the existing development south of the CSX right-of-way. East of the Falklands Chase apartments, Low Investment LRT would cross over the CSX tracks on an aerial structure to enter the Silver Spring Transit Center parallel to, but at a higher level than, the existing tracks.

From the Silver Spring Transit Center, High Investment BRT would continue along the CSX tracks until Silver Spring Avenue, where the alignment would turn east entering a tunnel, passing under Georgia Avenue, and turning north to Wayne Avenue. The alignment would return to the surface on Wayne Avenue near Cedar Street. It would continue on Wayne Avenue in dedicated lanes, crossing Sligo Creek Parkway, and entering a tunnel approximately half-way between Sligo Creek and Flower Avenue, then turning east to pass under Plymouth Street, crossing under Flower Avenue, and emerging from the tunnel on Arliss Street.

High Investment BRT would be the same as Medium Investment BRT on Piney Branch Road and University Boulevard except that the alignment would have grade-separated crossings over New Hampshire Avenue and Riggs Road.

Approaching University of Maryland, the alignment would cross under Adelphi Road. After Adelphi Road the alignment would follow Campus Drive and turn onto the proposed Union Drive extended. The alignment would enter a tunnel while on Union Drive, prior to Cole Field House, and pass through the campus under Campus Drive. After emerging from the tunnel east of Regents Drive, the alignment would be the same as Medium Investment BRT, until Paint Branch Parkway.

The alignment would continue east on Paint Branch Parkway in shared lanes to the College Park Metro Station. This alternative would turn right to enter the College Park Metro station on a new guideway immediately after the Metro Station parking garage on Paint Branch Parkway. The station would be provided in the new development, close to the Metro station entrance. The alternative would return to River Road and continue in dedicated lanes. The alignment would be dedicated on these roadways, except under the CSX bridge on Paint Branch Parkway.

From River Road, where the BRT is in dedicated lanes, to near Haig Drive, the alignment would turn right and enter a tunnel heading south, roughly parallel to Kenilworth Avenue. Near East West Highway (MD 410), the alignment would turn left and continue in the tunnel under Anacostia River Park. The alignment would transition to a surface alignment west of the Kenilworth Avenue/East West Highway intersection. The alternative would follow East West Highway in dedicated lanes.

High Investment BRT would turn right down Veterans Parkway in dedicated lanes. Unlike Medium Investment BRT, this alternative would cross under Annapolis Road before continuing on Ellin Road to the New Carrollton Metro Station.

University Boulevard with Dedicated Bus Lanes

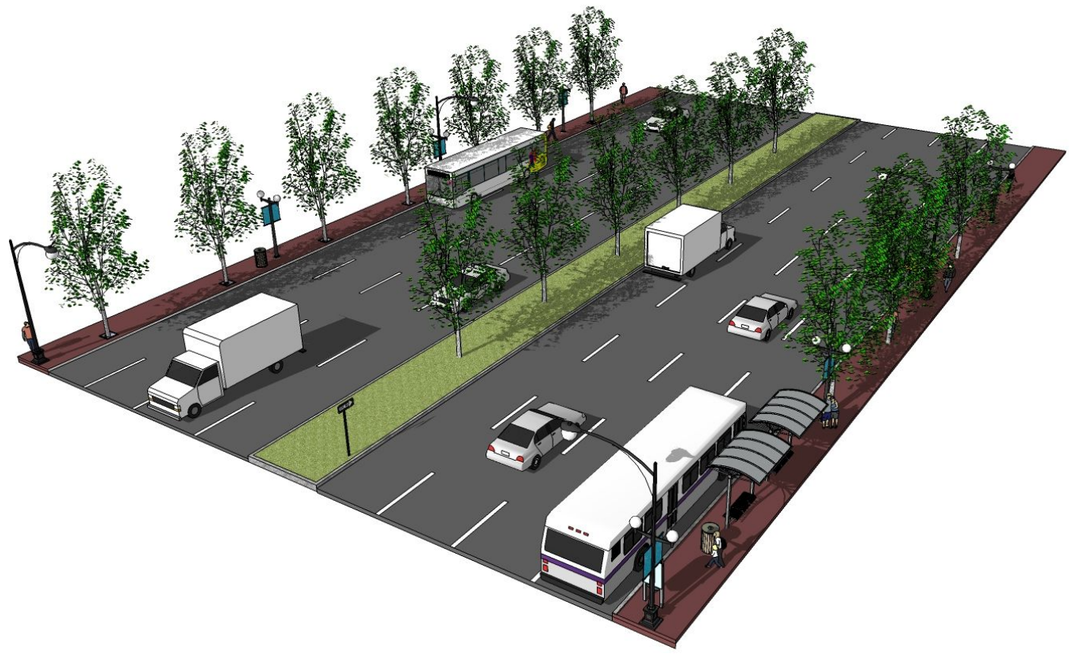
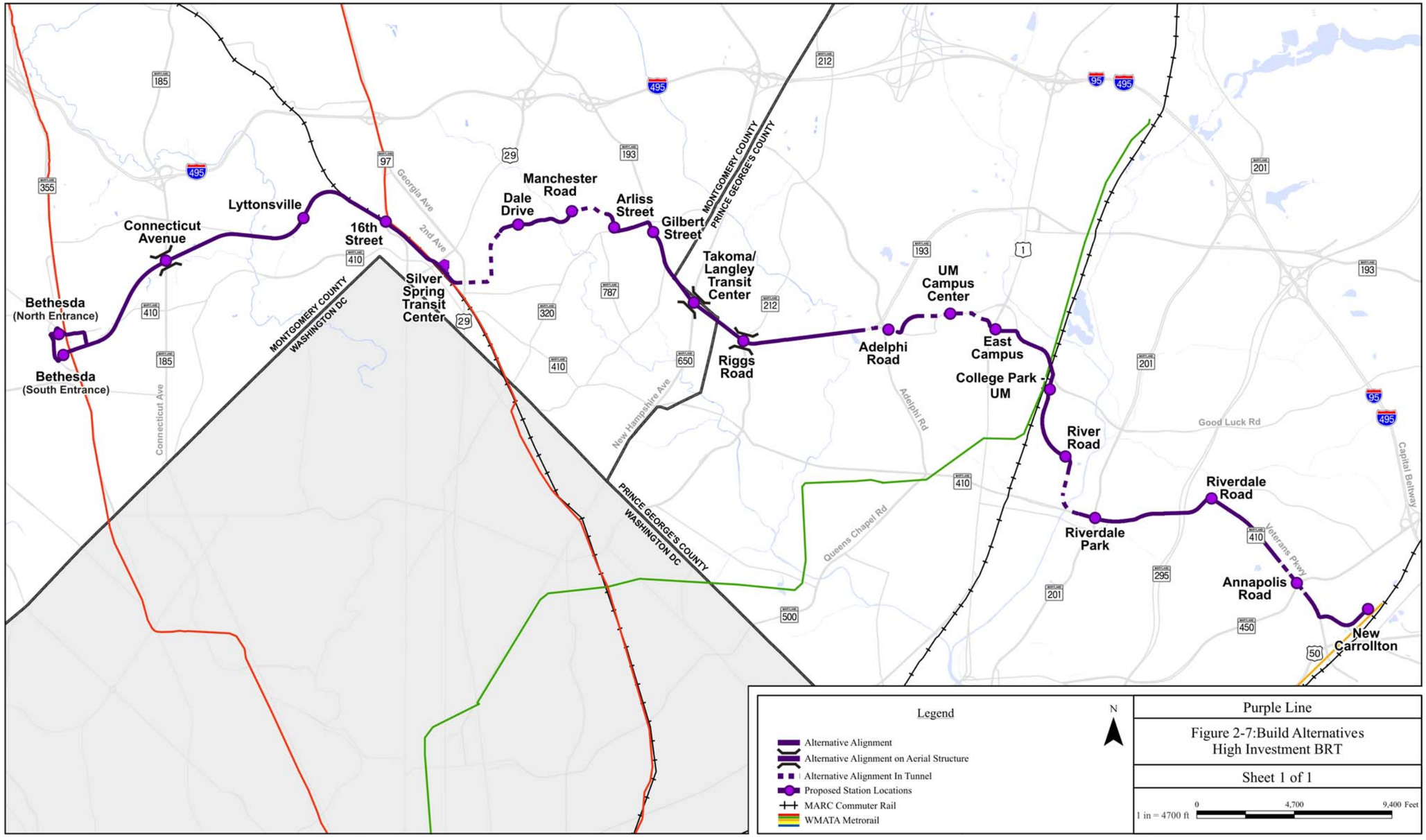


Figure 2-7: Alternative 5 - High Investment BRT

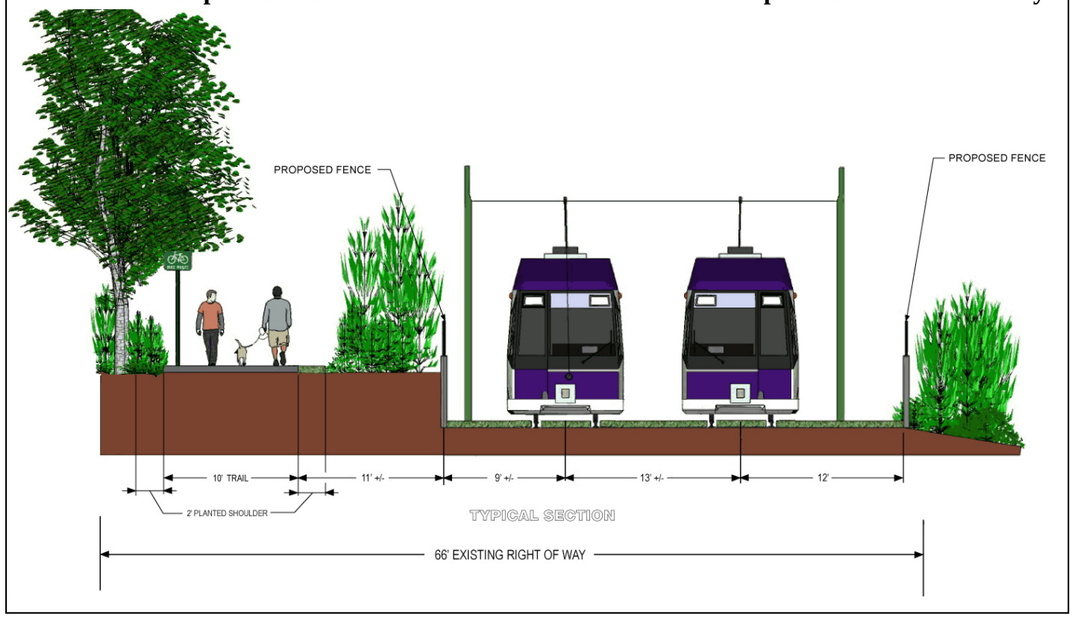


2.4.7. Alternative 6 – Low Investment LRT

Low Investment LRT would operate in shared and dedicated lanes with minimal use of vertical grade separation and horizontal traffic separation. All LRT Alternatives would serve only the south entrance of the Bethesda Metro Station and would operate there in a stub-end platform arrangement.

Low Investment LRT would begin on the Georgetown Branch right-of-way near the Bethesda Metro Station under the Air Rights Building. The hiker biker trail connection to the Capital Crescent Trail would not be through the tunnel under the Air Rights Building, but rather through Elm Street Park on existing streets. The terminal station would be the Bethesda Metro Station with a connection to the southern end of the existing station platform.

Capital Crescent Trail with Vertical and Horizontal Separation from Transitway



After emerging from under the Air Rights Building, the transitway would follow the Georgetown Branch right-of-way, crossing Connecticut Avenue at grade and crossing under Jones Mill Road. Between approximately Pearl Street and just west of Jones Mill Road, the trail would be on the north side of the transitway, elsewhere it would be on the south side.

The segment from Jones Mill Road to Spring Street in the CSX corridor would be the same as for Low and Medium Investment BRT.

After crossing Spring Street, Low Investment LRT would be the same as the Medium and High Investment BRT Alternatives, rising above the level of the existing development south of the CSX right-of-way. East of the Falklands Chase apartments, Low Investment LRT would cross over the CSX tracks on an aerial structure to enter the Silver Spring Transit Center parallel to, but at a higher level than, the existing tracks.

Low Investment LRT would be the same as Medium Investment BRT from the Silver Spring Transit Center to Bonifant Street to Wayne Avenue.

Turning right, Low Investment LRT would continue at grade on Wayne Avenue in shared lanes, crossing Sligo Creek Parkway and entering a tunnel from Wayne Avenue to pass under Plymouth Street. As with High Investment BRT the alignment emerges from the tunnel on Arliss Street.

The Low Investment LRT would then follow Piney Branch Road and University Boulevard at grade in dedicated lanes. In keeping with the low investment definition of this alternative, the major intersections of New Hampshire Avenue and Riggs Road would not be grade-separated.

As this alternative approaches Adelphi Road, the grade of the existing roadway is too steep for the type of LRT vehicles being considered. For this reason, the transitway would cross the intersection below grade.

At Adelphi Road, the alignment would enter the University of Maryland campus on Campus Drive. The alternative would follow the same alignment to the College Park Metro Station as described for Medium Investment BRT. It would continue through the University of Maryland campus in dedicated lanes on Campus Drive and then continue at grade in a new exclusive transitway through the parking lots adjacent to the Armory, behind the Visitors Center to Rossborough Lane.

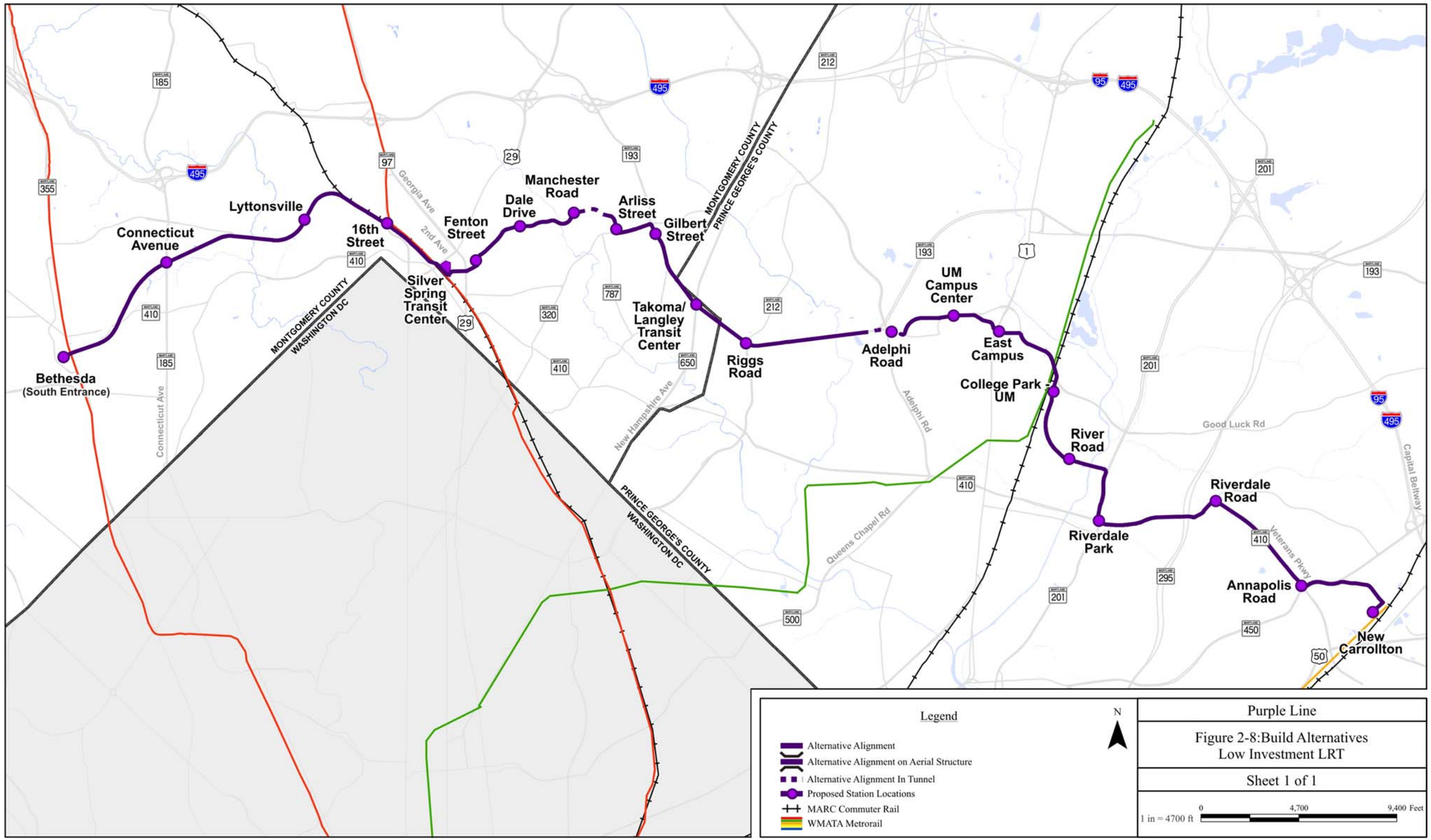
Crossing US 1 at grade, Low Investment LRT would pass through the East Campus development on Rossborough Lane to Paint Branch Parkway. The alignment would continue on Paint Branch Parkway in shared lanes. The LRT would enter the College Park Metro Station next to the existing parking garage.

From the College Park Metro Station to the terminus at the New Carrollton Metro Station, Low Investment LRT would be in dedicated lanes on River Road on the south side of the road. On Kenilworth Avenue the LRT would be in a dedicated lane southbound, but a shared lane northbound. On East West Highway the LRT would be in dedicated lanes with shared left turn lanes; and in shared lanes under Baltimore-Washington Parkway. On Veterans Parkway the LRT would be in dedicated lanes.

As with Low Investment BRT, this alignment would turn left on Annapolis Road from Veterans Parkway and then right on Harkins Road to the New Carrollton Metro Station. The segments on Annapolis Road and Harkins Lane would be dedicated.

University of Maryland Campus from Campus Drive

Figure 2-8: Alternative 6 – Low Investment LRT



2.4.8. Alternative 7 – Medium Investment LRT

Medium Investment LRT is the same as Low Investment LRT from Bethesda to the CSX corridor, except that the alignment would cross over Connecticut Avenue.

Along the CSX corridor the alignment would be the same as High Investment BRT, grade-separated (below) at 16th and Spring Streets. The alignment would be the same as Medium and High Investment BRT and Low Investment LRT, from Spring Street through the Silver Spring Transit Center.

From the Silver Spring Transit Center, the alignment would follow Bonifant Street in dedicated lanes to Wayne Avenue. On Wayne Avenue, this alterative would be in shared lanes with added left turn lanes.

This alternative would cross Sligo Creek Parkway and entering a tunnel from Wayne Avenue to pass under Plymouth Street. As with Low Investment LRT the alignment emerges from the tunnel on Arliss Street.

The Medium Investment LRT would then follow Piney Branch Road and University Boulevard at grade in dedicated lanes. The major intersections of New Hampshire Avenue and Riggs Road would not be grade-separated.

As this alternative approaches Adelphi Road, the grade of the existing roadway is too steep for the type of LRT vehicles being considered. For this reason, the transitway would cross the intersection below grade.

At Adelphi Road, the alignment would enter the University of Maryland campus on Campus Drive. The alternative would follow the same alignment to the College Park Metro Station as described for Medium Investment BRT and Low Investment LRT. The alignment would continue through the University of Maryland campus in dedicated lanes on Campus Drive and then continue at grade in a new exclusive transitway through the parking lots adjacent to the Armory, behind the Visitors Center to Rossborough Lane.

University of Maryland, Campus Drive at Hornbake Library

Crossing US 1 at grade, Medium Investment LRT would pass through the East Campus development on Rossborough Lane to Paint Branch Parkway. The alignment would continue on Paint Branch Parkway in shared lanes. The LRT would enter the College Park Metro Station next to the existing parking garage.

From the College Park Metro Station to the terminus at the New Carrollton Metro Station, Medium Investment LRT would be in dedicated lanes on River Road on the south side of the road. On Kenilworth Avenue the LRT would be in a dedicated lane southbound, but a shared lane northbound. On East West Highway, the LRT would be in dedicated lanes with shared left turn lanes; and in shared lanes under Baltimore-Washington Parkway. On Veterans Parkway the LRT would be in dedicated lanes.

The alignment would be the same as Low Investment LRT until Paint Branch Parkway, where it would be in dedicated lanes, except under the CSX/metro tracks at the College Park Metro Station, except for Paint Branch Parkway where it would be in dedicated lanes. After entering the College Park Metro Station, the LRT continues on River Road in dedicated lanes on the south side of the road. On Kenilworth Avenue, East West Highway, and Veterans Parkway the LRT operates in dedicated lanes. At the intersection of Veterans Parkway and Annapolis Road the LRT continues across Annapolis at grade, turning left at Ellin Road still in dedicated lanes to arrive at the New Carrollton Metro Station.

River Road with Dedicated Lanes on the South

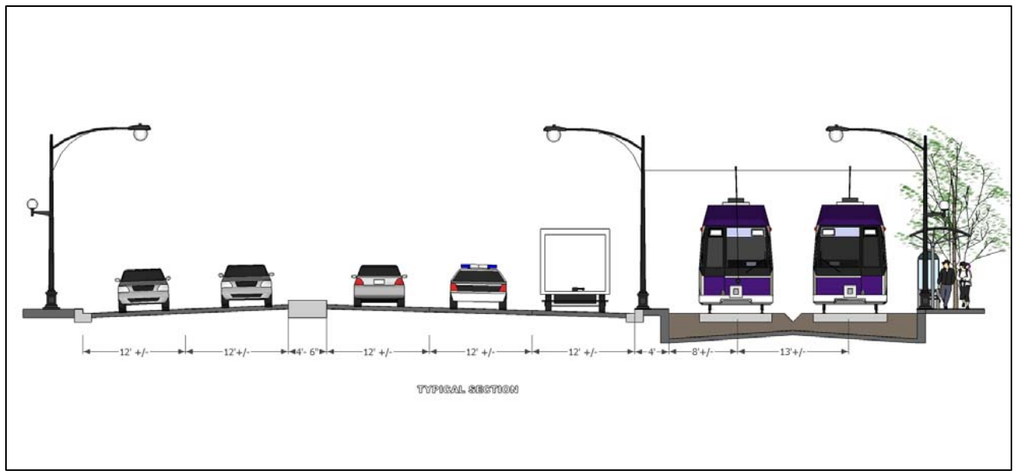
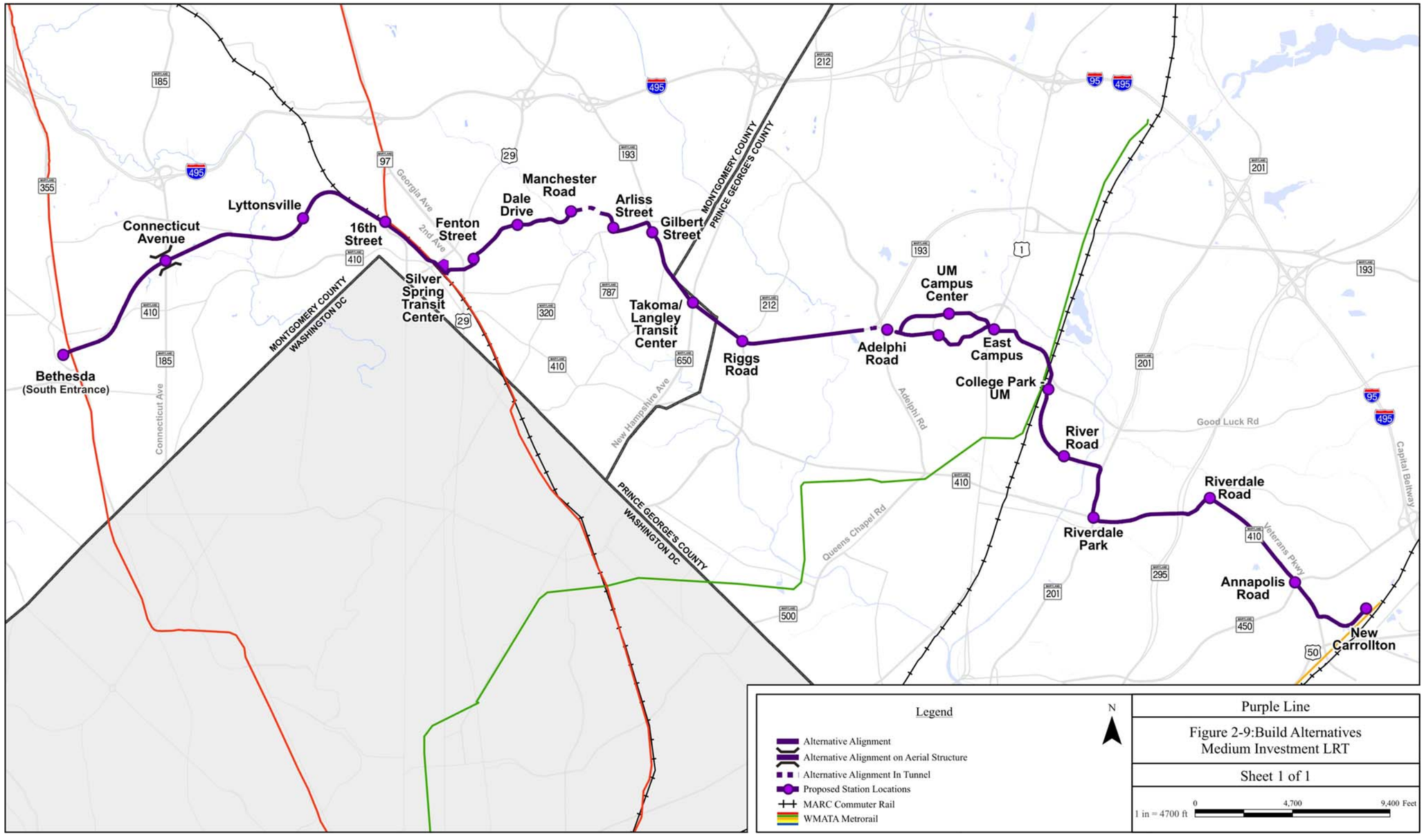


Figure 2-9: Alternative 7 – Medium Investment LRT



2.4.9. Alternative 8 – High Investment LRT

High Investment LRT is intended to provide the most rapid travel time of the LRT alternatives. It would make maximum use of vertical grade separation and horizontal traffic separation. Tunnels and aerial structures are proposed at key locations to improve travel time and reduce delay. When operating within or adjacent to existing roads, this alternative would operate primarily in dedicated lanes. High Investment LRT would be the same as the High Investment BRT Alternative, except for the Bethesda terminus. The alignment would begin just west of the tunnel under the Air Rights Building. The hiker biker trail would follow the alignment through the tunnel under the Air Rights Building. Because of physical constraints, the trail would be elevated above the westbound tracks. The trail would return to grade as it approaches Woodmont Avenue. The terminal station would be the Bethesda Metro Station with a connection to the southern end of the existing station platform.

High Investment LRT would begin under the Air Rights Building on the Georgetown Branch right-of-way. Elevators would provide a direct connection to the south end of the Bethesda Metro Station in the tunnel under the Air Rights Building.

The High Investment LRT Alternative would be the same as Medium Investment LRT until it reaches the CSX corridor. As with the other alternatives, this alternative would follow the CSX corridor on the south side of the right-of-way, and like Medium Investment LRT, it would cross 16th Street and Spring Street below the grade of the streets, at approximately the same grade as the CSX tracks. The station at 16th Street would have elevators and escalators to provide access from 16th Street.

The crossing of the CSX right-of-way would be the same as for Medium Investment LRT. From the Silver Spring Transit Center, High Investment LRT would continue along the CSX tracks until Silver Spring Avenue, where the alignment would turn east entering a tunnel, passing under Georgia Avenue, and turning north to Wayne Avenue. The alignment would return to the surface on Wayne Avenue near Cedar Street. It would continue on Wayne Avenue in dedicated lanes, crossing Sligo Creek Parkway, and entering a tunnel approximately half-way between Sligo Creek and Flower Avenue, then turning east to pass under Plymouth Street, crossing under Flower Avenue, and emerging from the tunnel on Arliss Street.

High Investment LRT would be the same as Medium Investment LRT on Piney Branch Road and University Boulevard except that the alignment would have grade-separated crossings over New Hampshire Avenue and Riggs Road.

LRT Passing through Columbia County Club on the Georgetown Branch Right-of-Way

Approaching University of Maryland, the alignment would cross under Adelphi Road. After Adelphi Road the alignment would follow Campus Drive and turn onto the proposed Union Drive extended. The alignment would enter a tunnel while on Union Drive, prior to Cole Field House, and pass through the campus under Campus Drive. After emerging from the tunnel east of Regents Drive, the alignment would be the same as Medium Investment LRT until Paint Branch Parkway, crossing US 1 at grade, it would pass through the East Campus development on Rossborough Lane to Paint Branch Parkway.

The alignment would continue east on Paint Branch Parkway in

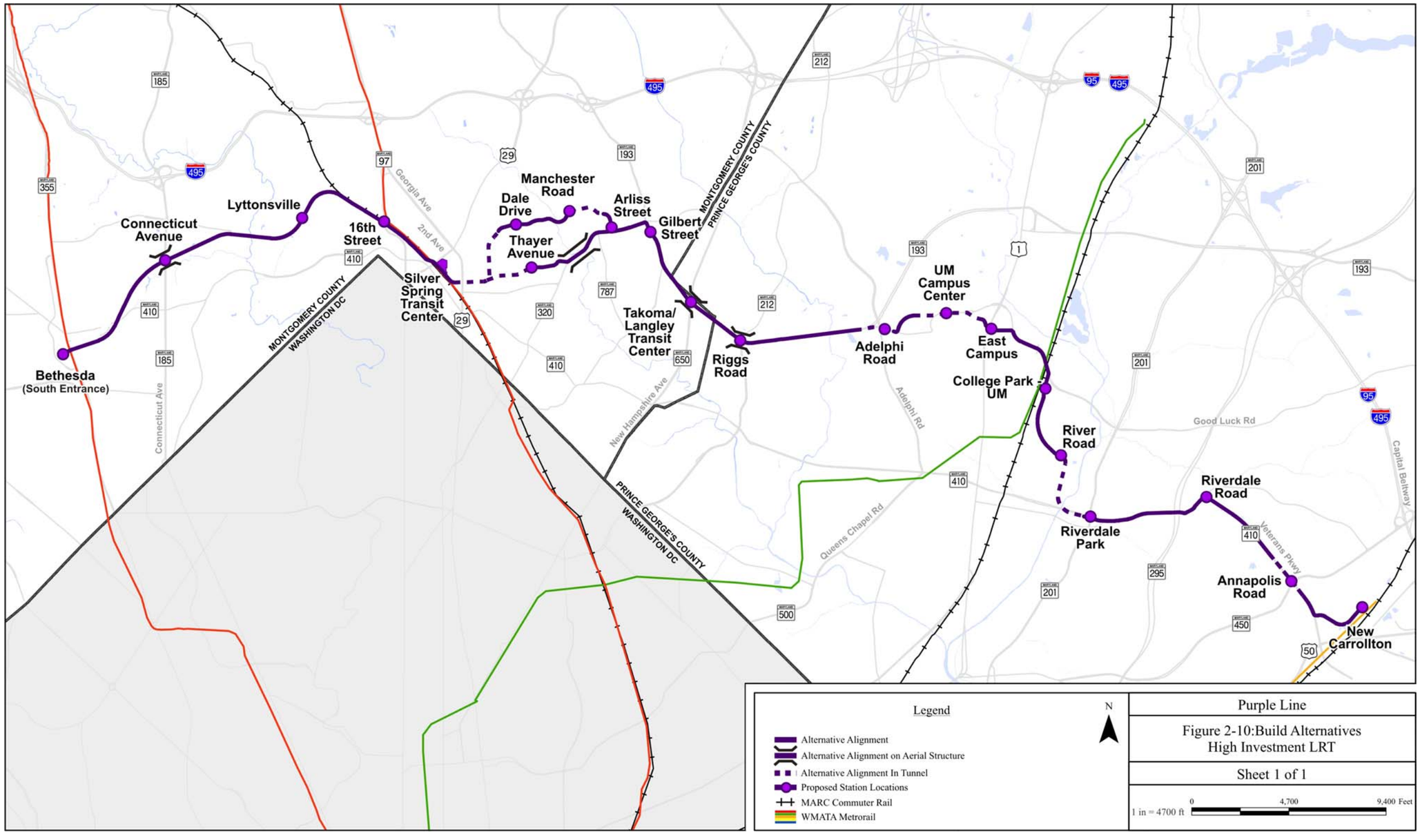
Wayne Avenue near Sligo Creek Parkway

shared lanes to the College Park Metro Station. The LRT would enter the College Park Metro Station next to the existing parking garage.

The alternative would then follow River Road in dedicated lanes on the south side of the road. From River Road near Haig Drive, the alternative would turn right and enter a tunnel heading south, roughly parallel to Kenilworth Avenue. Near East West Highway (MD 410), the alignment would turn left and continue in the tunnel under Anacostia River Park. The alignment would transition to a surface alignment west of the Kenilworth Avenue/East West Highway intersection. The alternative would follow East West Highway in dedicated lanes.

High Investment LRT would turn right down Veterans Parkway in dedicated lanes. Unlike Medium Investment LRT, this alternative would cross under Annapolis Road before continuing on Ellin Road to the New Carrollton Metro Station.

Figure 2-10: Alternative 8 – High Investment LRT



2.4.10. Design Options

The following design options are variations in the alignments that could be used in some of the alternatives.

North Side of CSX Design Option

This design option is based on the Georgetown Branch Master Plan. From the eastern end of the Georgetown Branch right-of-way the alignment would cross under the CSX corridor and then continue down the north side. It would emerge from the tunnel near Lyttonsville Road in Woodside. The alignment would be below the grade of 16th Street, passing under the bridge, but providing a station at that location. It would also pass under the Spring Street bridge but would begin to rise on an aerial structure over the CSX right-of-way 1,000 feet northwest of Colesville Road due to the location of the Metro Plaza building. The aerial structure over the CSX right-of-way would provide the required 23-foot clearance from top of rail to bottom of structure. The alternative would enter the Silver Spring Transit Center parallel to, but at a higher level than, the existing tracks.

South Side of CSX with a Crossing West of the Falklands Chase Apartments Design Option

This option would operate on the south side of the CSX, as described either at or below grade at 16th Street. The alignment would cross the CSX corridor between Spring Street and Fenwick Lane. This option would continue along the north side of the CSX right-of-way on an aerial structure over the CSX right-of-way 1,000 feet northwest of Colesville Road, due to the location of the Metro Plaza building. The aerial structure over the CSX right-of-way would provide the required 23-foot clearance from top of rail to bottom of structure. The alternative would enter the Silver Spring Transit Center parallel to, but at a higher level than, the existing tracks.

Silver Spring/Thayer Avenue Tunnel Design Option

This design option would begin at the Silver Spring Transit Center where the alignment leaves the CSX corridor near Silver Spring Avenue. It would enter a tunnel on Silver Spring Avenue passing under Georgia Avenue and Fenton Street. At approximately Grove Street, the alignment would shift northward to continue under the storm drain easement and backyards of homes on Thayer and Silver Spring Avenues. The transitway would emerge from the tunnel behind the East Silver Spring Elementary School on Thayer Avenue west of Nolte Avenue and then follow Thayer Avenue across Dale Drive to Piney Branch Road. A station would be located on Thayer Avenue adjacent to the tunnel portal. If the mode selected were LRT, the grade of Piney Branch Road would require an aerial structure from west of Sligo Creek and Sligo Creek Parkway and would return to grade just west of Flower Avenue. This aerial structure requires that the road be widened. For this design option, a station would be located on Thayer Avenue where the alignment would emerge from the tunnel.

University of Maryland Campus via Preinkert/Chapel Drive Design Option

The Preinkert/Chapel Drive alignment is being evaluated as a design option for both BRT and LRT through the campus of the University of Maryland. The alignment would run from the west on Campus Drive turning right onto Preinkert Drive where it would head southeast. The transitway would turn left to pass directly between LeFrak Hall and the South Campus Dining Hall and then northeast through the Lot Y parking lot. From there, the alignment would run east along Chapel Drive between Memorial Chapel and Marie Mount Hall and eventually would pass to the south of Lee Building at Chapel Fields. The alignment would continue onto Rossborough Lane, passing directly north of Rossborough Inn to cross US 1, and continue east through the East Campus development.

Purple Line between LeFrak Hall and South Campus Dining Hall

2.4.11. Stations and Station Facilities

Table 2-5 provides the station locations, the markets served, and the connecting transit service at each station.

Stations would include shelters, lighting, ticket vending machines, and possibly landscaping and benches, where appropriate. Intelligent Transportation Systems would be used to provide real-time information on transit services at the stations. The station platforms would be approximately 200 feet long and ten feet wide. The stations would usually be incorporated into the existing sidewalks, except where large ridership necessitates a wider platform. Where stations are in the median of a roadway they would likely be 12 to 15 feet wide to provide a greater sense of comfort for transit passengers. Although the actual design of the stations is not part of this stage of the project, the station design would make it readily identifiable as serving the Purple Line.

No new park-and-ride facilities would be constructed as part of the Purple Line. Parking garages exist near the Bethesda and Silver Spring Metro Stations, and at the College Park and New Carrollton Metro Stations.

Additional kiss-and-ride facilities would be considered at the following stations: Connecticut Avenue at the Georgetown Branch right-of-way and Lyttonsville. Silver Spring Transit Center, College Park, and New Carrollton already have kiss-and-ride parking facilities available and the Purple Line would not add more. It has been determined that kiss-and-ride facilities are not needed at the Takoma/Langley Transit Center.

2.4.12. Ongoing Planning

This document presents a record of the planning for the Purple Line up to the current time; however, interaction with local communities, agencies, and other stakeholders continues; and continued studies may refine aspects of the alternatives, including possible additional design options. Two segments of the corridor under active study are the University of Maryland and the area east of downtown Silver Spring.

The segment of the corridor between the Silver Spring Transit Center and the Arliss station is an area that has been the focus of ongoing community interaction and the development and evaluation design options. At the request of local residents the MTA evaluated a number of design options including extended the tunnel included in the High Investment alternatives. An underground station at Dale Drive is also under study for the extended tunnel options. Along with engineering feasibility, constructability, cost, and mobility benefits, the issues associated with traffic, parks, community facilities, and local access are being considered. Coordination with stakeholders will continue throughout the planning process and could modify aspects of the alternative considered during the selection of the Locally Preferred Alternative.

Table 2-5: Proposed Stations, Markets, and Connecting Transit Services

Stations/Stops	Location	Markets Served	Connecting Transit Services
Bethesda Metro Station		Central business and residential district, and transfers	Metrorail Red Line; WMATA: J2, J3, J7, J9; Ride On: 29, 30, 32, 33, 34, 36, 42, 47, 70, 92
NIH/Medical Center (Low Investment BRT only)	Wisconsin Avenue and Jones Bridge Road	NIH, NNMC, and residential and transfers	Metrorail Red Line; WMATA: J2, J3, J7, J9; Ride On: 30, 33, 42, 46, 70,
Connecticut Avenue (Low Investment BRT only)	Jones Bridge Road	Residential	WMATA: L7, L8
Connecticut Avenue (all alternatives except Low Investment BRT)	Georgetown Branch ROW	Local business and residential	WMATA: L7, L8
Lyttonsville Place	Georgetown Branch ROW	Local business and residential	Ride On: 2,
16th Street	CSX ROW	Local business and residential, and transfers	WMATA: J5, Q2, Y5, Y7, Y8, Y9; Ride On: 3, 4, 5, 127
Silver Spring Transit Center		Central business and residential district, entertainment, and transfers	Metrorail Red Line; MARC Brunswick Line; UM Shuttle 111; WMATA: F4, F6, J1, J2, J3, J5, Q2, S2, S4, Y5, Y7, Y8, Y9, Z2, Z6, Z8, Z9, Z11, Z13, Z29, 70, 71, 79; Ride On: 1, 2, 3, 4, 5, 8, 9, 11, 12, 13, 14, 16, 17, 18, 19, 20, 22, 28, 127
Fenton Street (all alternatives except High Investment BRT and LRT)	Wayne Avenue	Central business and residential district, and transfers	WMATA: F4, F6; UM Shuttle 111; Ride On: 12, 16, 17, 19, 20, 28
Dale Drive	Wayne Avenue	Local residential	Ride On: 3, 12, 19; UM Shuttle 111
Manchester Road	Wayne Avenue	Local residential	Ride On: 12, 13, 19
Thayer Avenue	Thayer Avenue west of Nolte Avenue	Local residential	Ride On: 20
Arliss Street	Piney Branch Road	Local business and residential	Ride On: 14, 16, 20, 24
Gilbert Street	University Boulevard	Local business, and residential, and transfers	WMATA: C2, C4
Takoma/Langley Transit Center	University Boulevard and New Hampshire Avenue	Local business and residential, and transfers	WMATA: C2, C4, F8, K6; UM Shuttle 111; Ride On: 16, 17, 18; TheBus: 17, 18
Riggs Road	University Boulevard	Local business and residential,	WMATA: C2, C4, F8, R5, R1, R2; TheBus: 17, 18
Adelphi Road	Campus Drive at UMUC	Residential, UMUC, and transfers	WMATA: C2, C8, F6, F8, R3; TheBus: 17
UM Campus Center		UM	WMATA: C2, C8, F6; UM Shuttles; TheBus: 17,
East Campus	US 1	Commercial, hotel, residential, UM, and transfers	WMATA: C2, C8, F6, 81, 83, 86; TheBus: 17
College Park Metro Station		M-Square Research Park, residential, future mixed-use development, and transfers	Metrorail Green Line; MARC Camden Line; WMATA: C2, C8, F6, R12, 83, 86; TheBus: 14, 17 CAR: G, H
River Road	River Tech Court	M-Square Research Park and residential	WMATA : F6, R12; TheBus: 14
Riverdale Park	Kenilworth Avenue and MD 410	Local business and residential and transfers	WMATA: F4, R12, 84, 85; TheBus: 14
Riverdale Road	Veterans Parkway	Local business and residential	WMATA: F4, 84, 85; TheBus: 14
Annapolis Road	Veterans Parkway	Local business	WMATA: F13, T18,
New Carrollton Metro Station		Business and residential, including IRS, CSC; future mixed-use development, and transfers	Metrorail Orange Line, MARC Penn Line, Amtrak; WMATA: B21, B22, B24, B25, B27, B29, B31, C28, F4, F6, F12, F13, F14, R12, T16, T17, T18, 84,85, 88; TheBus: 15, 16, 21, 21X

Notes: A) Bus operators – Metrobus = WMATA, Ride On = Montgomery County, TheBus = Prince George's County, CAR = Connect a Ride

B) WMATA J1 discontinued under Low Investment BRT Alternative

C) WMATA J4 and Ride On 15 replaced by all Purple Line alternatives

2.5. Service Concept

The diverse land uses and economic base in the Purple Line corridor include residential, commercial, industrial, institutional, and governmental sectors. This generates a wide variety of trip types and purposes that reflect the equally wide range of demographics of the region.

Currently, there is bus service throughout the corridor, with several of the highest ridership bus routes in the region. The Purple Line would enhance and expand the existing service by providing a higher speed, higher capacity, and more reliable trunkline service.

The MTA has identified eight alternatives for detailed study. The alternatives are No Build, a TSM alternative, and six Build alternatives. The two modes, LRT and BRT, provide flexibility since they can be used both in exclusive rights-of-way and on roadways in shared lanes. The heavily built-up nature of the corridor may require that the transit vehicles travel, at least in part, in shared lanes on existing roadways. These transit technologies allow the consideration of a range of alignment configurations examining the trade off between travel time and speed, costs, and impacts, as well as providing the east-west transit service and connectivity that is one of the project goals.

Purple Line service planning includes not only 2030 plans for the corridor alternatives but also plans for the background local bus network operated in the region. Service plans discussed in detail below for the TSM alternative and each of the six Build alternatives endeavor to create a route network as interconnected as possible. Redundant and overlapping service has been proposed for elimination, while other routes have been restructured to provide increased connectivity with the corridor service to provide more convenient, user-focused service for passengers.

All of the Build alternatives serve the same markets (i.e., alignments and stations are quite similar). All alternatives serve downtown Bethesda directly with the trunkline service; however, only Low Investment BRT directly serves the National Institutes of Health and the National Naval Medical Center area. All others, including the No Build and TSM alternatives, serve this market with improved bus service, connecting Silver Spring as well as Metrorail service to Bethesda.

Minor variations may occur in station locations due to actual alignment. For example, the Connecticut Avenue Station could have one of three locations depending on the alternative: at Jones Bridge Road for Low Investment BRT; at the Georgetown Branch right-of-way alignment for Low Investment LRT, and Medium and High Investment BRT and LRT; and at East West Highway for the TSM. The actual locations of the stations would be determined in later design and engineering phases of the project. The principal difference among alternatives is in their use of shared and dedicated lanes and at-grade, tunnel, and elevated running ways.

2.6. Service Characteristics

The low investment alternatives for both BRT and LRT would use as much existing roadway as possible and would, for the most part, operate in shared lanes. The high investment alternatives would operate in exclusive or dedicated lanes in a number of areas. Light rail transit is constrained by how steep a grade on which it can operate safely, and for this reason some portions of the LRT alignment would be in a tunnel or on elevated structures even for the low investment alternative. However, in general, the tunnel or elevated segments have been included to improve travel speeds or reduce community impacts. The medium investment alternatives would be somewhere between the high and low investment alternatives, with investments made where the benefits returned would be greatest.

The differences among alternatives in their use of shared and dedicated lanes and at-grade, tunnel, and elevated running ways would have little effect on market coverage because the station locations of the different alternatives are identical in most cases. Differences in levels of ridership would be due to travel time savings provided by the exclusive running ways of the higher investment alternatives.

For the purpose of the alternatives analysis, which is to identify the differences among different levels of investment, a number of the service-related characteristics have been held constant across all the alternatives. These characteristics include the following:

- Headways
- Fares
- Hours of service

2.6.1. Headways

The headways for the TSM and all Build alternatives would be six minutes each direction during peak hours and ten minutes off peak.

2.6.2. Fares

Metrorail Fares

Regular Metrorail fares (2007) ranging from $1.65 to $4.50 are in effect on weekdays from opening to 9:30 AM, 3-7 PM, and 2 AM to closing. Reduced fares ranging from $1.35 to $2.35 are in effect at all other times. These fares are based on distance traveled.

SmarTrip cards and other multi-trip passes may be purchased at Metrorail stations, Metro sales offices, retail outlets, or Commuter Stores.

Metrobus Fares

The Metrobus fares are summarized in Table 2-6.

Table 2-6: Metrobus Fares (2007)

Regular Fare - cash	$1.35
Regular Fare - SmarTrip	$1.25
Express Bus Fare	$3.10
Transfers	Free
Metrorail-to-Metro bus transfers	Free

TheBus Fares

TheBus uses a single, flat fare for all trips on its services. Adult fares are as shown in Table 2-7.

Table 2-7: TheBus Fares (2007)

Regular Fare	$0.75
Metrobus and Ride On-to-Transfer	Free
Metrorail-to-TheBus transfer	$0.25
TheBus-to-Metrobus and Ride On Transfer	$0.50

Ride On Fares

Ride On uses a single, flat fare for all trips. Fares for these services are shown in Table 2-8. SmarTrip cards may be used on Ride On.

Table 2-8: Ride On Fares (2007)

Regular Fare or Token	$1.25
Local Bus Transfer (Valid for 2 hours, any direction)	Free
Metrorail-to-Ride On Bus Transfer	$.35

Ride On accepts Metrobus and other local bus transfers at any stop on any route until its expiration time. Metrobus accepts Ride On and other local bus transfers at any stop in their system.

Purple Line Fare Assumptions

TSM

TSM fare is assumed to be a flat fare following the regular Metrobus fares described above. Cash fares and multi-trip passes will be accepted by operators upon boarding the vehicle. All fare passes would be made available at Metrorail stations. SmarTrip cards and other multi-trip passes may also be purchased at Metro sales offices, retail outlets, or Commuter Stores.

BRT and LRT

It is assumed that BRT and LRT fares would be a flat fare following the regular Metrobus fares described above. To expedite boarding and alighting, a proof-of-purchase payment method is assumed with tickets purchased from ticket vending machines at stations. Passengers would board through multiple doors to speed loading. Roving, on-board fare inspectors would be required to reduce the incidence of fare evasion, as is typical of most proof-of-purchase operations in the United States. SmarTrip cards and other multi-trip passes may also be purchased at Metro sales offices, retail outlets, or Commuter Stores.

Fares for Purple Line service, as described above, will initially replicate existing Metrobus fare structure and policies. Purple Line transfers to Metrobus and Metrorail will initially be free. Transfers to other local services will be equal to existing bus-to-bus transfer policies. Fare structure and policy will be re-examined as the Purple Line advances toward implementation when the operator of the Purple Line is determined and agreements among local transit service providers have been reached.

2.6.3. Hours of Service

Purple Line service would operate at approximately the same hours as Metrorail. Service would begin at terminal stations at 5 AM weekdays and 7 AM on Saturday and Sunday and would operate through midnight Sunday through Thursday and until 3 AM on Friday and Saturday. All times are approximate and might vary slightly. Because service start time would be scheduled for terminal stations, first trains would leave many stations later than system opening times and last trains would leave earlier than closing times.

2.6.4. Feeder Bus Service

An extensive and comprehensive bus network is currently in place along the Purple Line corridor, operated by WMATA and the two counties. While many of these routes have a role in serving purely local travel markets, a very large number of them feed the Metro stations at Bethesda, Silver Spring, College Park, and New Carrollton. Thus they are a ready-made feeder bus network for the Purple Line, which would serve those Metro stations. The number of routes performing this feeder function is considerable, 14 routes at Bethesda, 28 routes at Silver Spring, 10 routes at College Park and 24 routes at New Carrollton. In addition, nine bus routes plus the UM Shuttle currently serve the area of the intersection of University Boulevard and New Hampshire Avenue. This intersection is the site of the future Takoma/Langley Transit Center, a planned and programmed facility that will serve existing bus routes, as well as the Purple Line, and will provide enhanced amenities to transit patrons. Construction of the Transit Center is expected to be completed in 2009.

If the Purple Line were built some feeder bus route revisions would be made to better serve the Purple Line stations. Given the extensive existing bus network, these changes would be relatively minor in scope. Because all six Build alternatives serve the same markets and have stations that are, for the most part, in the same locations, feeder bus service would be the same for all Build alternatives.

2.6.5. Operating Characteristics

Table 2-9 summarizes the operating characteristics of the TSM alternative and the Build alternatives. The TSM and BRT vehicle fleets could be a combination of articulated or standard buses. In Table 2-9 the vehicle requirements for these alternatives would be the equivalent standard bus vehicles, as this represents the worse case for various operational, facility sizing, costing, and environmental assessment purposes. LRT trains are assumed to be consists up to three 60-foot cars, although two 90-foot cars could be used instead. Like the bus vehicles, basing the light rail vehicle requirements on the 60-foot car represents the worse case for various operational, facility sizing, costing, and environmental assessment purposes.

Table 2-9: Operating Characteristics of Alternatives

Alternative	End-to-End Travel Time, Peak Period (minutes)	End-to-End Average Speed (mph)	Peak Vehicle Requirement (including spares)
TSM	108	9	68
Low Investment BRT	96	10	60
Medium Investment BRT	73	13	49
High Investment BRT	59	16	42
Low Investment LRT	62	15	44
Medium Investment LRT	59	16	44
High Investment LRT	50	19	44

2.6.6. Ancillary Facilities

Maintenance and Storage Facilities

LRT and BRT both require maintenance and storage facilities; however, the requirements in terms of location and size are not the same. LRT requires a facility located along the right-of-way while a BRT facility can be located elsewhere. Depending on the construction phasing and mode chosen, two maintenance facilities (one in Montgomery County and one in Prince George's County) are ideal.

The size of the facility depends on the number of vehicles required. A fleet of 40 to 45 LRT vehicles (including spares) would require approximately 20 acres. A BRT facility for the Purple Line would generally require facilities of similar size. The Purple Line would also require storage for non-revenue vehicles and equipment such as maintenance, supervisory, and security vehicles.

Activities at the maintenance and storage facility would include:

- Vehicle storage area (tracks for LRT)
- Inspection and cleaning
- Running way repairs
- Vehicle maintenance and repair
- Operations
- Security
- Parking
- Materials and equipment storage

Two sites improve operations by providing services and storage near the ends of the alignment. It is possible to have one site provide

the majority of the services and the other function as an auxiliary site.

Existing Bus Maintenance Facilities

BRT requires a garage facility; however, this need could possibly be met by sharing an existing bus garage.

The following text documents the current capacity, future capacity, and expansion plans at each of the identified bus facilities. Currently, WMATA, Montgomery County, and Prince George's County provide bus service within the corridor. These three agencies operate and maintain the Metrobus, Ride On, and TheBus, respectively. The sections below summarize which agencies have bus maintenance facilities in or around the corridor, the location of each facility, and current and future capacity issues.

WMATA

WMATA has two bus maintenance facilities located near the corridor that service Metrobus – the Landover Bus Garage at 3433 Pennsy Drive, Landover, and the Montgomery Bus Garage at 5400 Marinelli Road, Rockville. These maintenance facilities are located on either end of the corridor. Characteristics of these two facilities are described below.

The Landover bus facility is 2 miles northeast of the New Carrollton Station. The facility is approximately 58,800 square feet in size and can accommodate up to 250 buses. According to 2006 numbers, the facility currently maintains and stores 167 buses, although WMATA reports the facility is fully utilized. The majority of buses stored at this facility are diesel-propelled coaches, 40 feet and under in length. The Montgomery bus facility is located in Rockville approximately 5 miles north of the Bethesda Station. The facility is approximately 65,000 square feet in size and can accommodate up to 250 buses. According to 2006 numbers, the facility currently maintains and stores 163 buses and like the Landover Bus Garage, is reported as being fully utilized. The majority of buses stored at this facility are diesel-propelled coaches, 60 feet and under in length.

Montgomery County – Ride On

Montgomery County has one bus maintenance facility in Lyttonsville to service its Ride On vehicles. This facility is adjacent to the Georgetown Branch right-of-way on Brookville Road and currently maintains 140 buses with projections of reaching 150 buses in the very near future. This facility occupies 50 to 60 acres and has a cross discipline of uses, including highway services, a fueling facility, and salt domes. This facility maintains a variety of 40-foot low-floor buses, including a small percent of 40-foot hybrid buses, 35-foot and 30-foot buses. The bus facility has a bus wash but does not have pull-through bus maintenance bays, which would make maintenance on a 60-foot articulated bus difficult.

Montgomery County does plan to build a new bus maintenance facility in 2012-2013 in Clarksburg. However, Clarksburg is over 20 miles from Bethesda, which is too far to serve the Purple Line.

Prince George's County – TheBus

Prince George's County does not have a bus maintenance facility close to the corridor. The closest maintenance facility is in Forestville, south of Largo, ten miles south of New Carrollton. This facility currently maintains and stores approximately 90 buses, which is about half of its designed capacity. The maintenance facility is not expected to reach capacity until at least 2012.

Maintenance and Storage Facilities

A site for a maintenance and storage facility has been identified on Brookville Road in the Lyttonsville area in Montgomery County where the County's Ride On buses and school buses are currently serviced. The Purple Line would require the use of some additional adjacent property. This site could serve either BRT or LRT.

In Prince George's County, a site has been identified on the south side of Veterans Parkway near the West Lanham Shopping Center. This site, the Glenridge maintenance facility, is owned by M-NCPPC and currently being used as a maintenance facility for park vehicles.

These two sites provide sufficient capacity for either BRT or LRT operations; and are well located near either end of the alignment.

Several other sites were evaluated. These sites are:

- **River Tech Court** – This site, off River Road was considered for a maintenance and storage facility. Initially suggested to the MTA by the University of Maryland, the University later announced its intention to sell the property to developers, making it no longer available to the MTA.
- **North Veterans Parkway** – This site, located on the north side of Veterans Parkway, is heavily wooded with over 23 acres of forest. The site includes approximately 380 linear feet of streams and 21 acres of highly erodible soils. Because the site includes steep grades it would require extensive grading. This site has substantial environmental impacts and because of the required grading and retaining walls, a high cost. For this reason it was dropped from further consideration.
- **MTA New Carrollton Property** – This site is property owned by the MTA on the east side of the New Carrollton Metro Station. This site includes over two acres of wetlands and 1500 linear feet of streams. In addition it is not particularly conveniently located because it would require the Purple Line to pass under or around the New Carrollton Metro Station. While there is support for extending the Purple Line farther east, and the present project is being planning not to preclude such a future extension, this site would have major costs due to its location east of the New Carrollton Station and tracks. Because of this and because of the substantial water resource impacts, this site was dropped from further consideration.
- **Haig Court** – located on River Road at Haig Court. This site would have only required minimal grading but it includes over 7 acres of forest. It is also very close to the residential neighborhood of Riverdale Park, which is a historic district. This site was dropped from further consideration because of concern about impacts to the community.

Traction Power Substations

Light rail's electric traction power system requires electrical substations approximately every 1.25 miles depending on the frequency and size of the vehicles. These substations, which are approximately 10 feet by 40 feet, do not need to be immediately adjacent to the tracks. This flexibility means the substations can be located to minimize visual intrusions and they can be visually shielded, either by fencing, landscaping, or walls, or they can be incorporated into existing buildings. The number and location of these substations will be determined during the

preliminary engineering phase of project development.

The LRT would be powered by an overhead electrical system. This system would include overhead wires used to power the vehicles, poles to support the wires and the traction power substations described above. The overhead wire technology selected by the MTA would be a trolley wire. Trolley wire is a single wire system suspended by poles 17 to 22 feet about the street over each track. The poles would be located either between the two tracks, or on either side of the roadway, depending on the configuration of the alternative at that particular location. The poles are typically located every 100 to 120 feet. Where curves are sharp, the poles and support wires would need to be more closely spaced.

Chapter 3
Transportation and Traffic

Chapter 3. Transportation and Traffic

In this chapter, the transportation and traffic impacts of the No Build, TSM, and six Build alternatives are evaluated. This chapter is organized into sections that describe regional travel patterns and potential impacts on public transportation, highways and roadways, parking, bikeways, and major pedestrian pathways.

3.1. Public Transportation

3.1.1. No Build Alternative

Existing transit service in the corridor is provided by WMATA Metrorail and Metrobus, Montgomery County Ride On local bus, Prince George's County TheBus local bus, the University of Maryland Shuttle, MARC commuter rail, and Amtrak. Table 3-1 lists the principal existing transit services within the corridor.

The transit service levels in the Constrained Long Range Plan (CLRP) are assumed for the No Build alternative except for the Bethesda to Silver Spring segment of the Purple Line.

Transit projects in the Maryland Consolidated Transportation Program (FY 2007–2012) located within the corridor, and expected to be in place by 2030, include the following:

- Southern Entrance to Bethesda Metro Station – A new entrance to the mezzanine of the Bethesda Metro Station at the southern end of the platform. This second entrance was anticipated at the time of the initial construction of the Metro station, but left unbuilt until ridership required it. The design of this project has been funded by Montgomery County and is currently underway.
- Silver Spring Transit Center – This project provides a fully integrated transit center at the Silver Spring. It will include bus bays for Metrobus and Ride On, an intercity bus facility, a taxi queue area, and a kiss-and-ride facility. Construction has begun on this facility and should be complete by 2010. Provisions have been made in the transit center design to accommodate the Purple Line. For the TSM and Low Investment BRT the buses would use the middle level bus facility.
- Takoma/Langley Park Transit Center – A new transit center will be built at the northwest corner of the University Boulevard and New Hampshire Avenue intersection. It is expected to be completed by 2010. The TSM and all the Build alternatives would have a station at this transit center. This project is being funded by the State of Maryland and Montgomery and Prince George's Counties.

Table 3-1: Existing Transit Service

Route	Terminal & Intermediate Points
Metro Red Line	Shady Grove – Glenmont
Metro Green Line	Greenbelt – Branch Avenue
Metro Orange Line	Vienna/Fairfax/GMU – New Carrollton
WMATA J1, J2, J3	Montgomery Mall – Bethesda – Silver Spring Metro
WMATA J4	Bethesda Metro – Silver Spring – College Park Metro
WMATA C2	Wheaton Metro – Greenbelt Metro
WMATA C4	Twinbrook Metro – Prince George's Plaza Metro
WMATA F4	Silver Spring – New Carrollton
WMATA F6	Silver Spring – New Carrollton
Ride On 15	Silver Spring Metro – Langley Park
TheBus 17	Langley Park – UM – College Park Metro
UM Shuttle 111	UM – Silver Spring Metro
UM Shuttle 104	UM – College Park Metro
MARC Brunswick Line	Washington – Rockville – Gaithersburg - Brunswick
MARC Penn Line	Washington – BWI Thurgood Marshall Airport – Baltimore –Perryville
MARC Camden Line	Washington – Baltimore
Amtrak Northeast Corridor	Washington – New York and points north and south

The Metrorail system opens at 5 AM on weekdays and 7 AM on weekends. It operates until midnight Sunday through Thursday and until 3 AM on Fridays and Saturdays.

Metrobus schedules vary by route, with most routes running every day. Ride On schedules also vary by route, with most routes running daily. TheBus buses operate Monday through Friday, with no service on weekends or holidays. Bus headways on all three systems vary by time of day. Table 3-2 lists the bus routes within the corridor and their headways. Transit service to the National Naval Medical Center/National Institutes of Health area is provided from Silver Spring and points east via the WMATA J1 route, while the Red Line Medical Center Metro Station connects to the entire rail-bus network.

Table 3-2: Bus Headways within the Corridor (minutes)

Route	Terminal and Intermediate Points	Early Morning	AM Peak	Midday	PM Peak	Evening	Saturday	Sunday
WMATA J1	Montgomery Mall-Medical Center-Silver Spring Metro	--	20	--	20	---	--	--
WMATA J2	Montgomery Mall-Bethesda-Silver Spring Metro	20	17	20	24	15	20	25
WMATA J3	Montgomery Mall-Bethesda-Silver Spring Metro	--	17	--	24	--	--	--
WMATA J4	Bethesda Metro-Silver Spring-College Park Metro	--	20	--	20	--	--	--
WMATA C2	Wheaton Metro-Greenbelt Metro	--	22	30	16	--	30	--
WMATA C4	Twinbrook Metro-Prince George's Plaza Metro	10	22	30	16	30	30	16
WMATA F4	Silver Spring – New Carrollton	12	12	40	15	--	30	60
WMATA F6	Silver Spring – New Carrollton	--	20	40	30	--	--	--
Ride On 15	Silver Spring Metro-Langley Park	15	4	12	4	30	12	15
TheBus 17	Langley Park-UM-College Park Metro	45	45	45	45	--	--	--
UM Shuttle 111	UM – Silver Spring Metro	--	35	75	45	30	--	--
UM Shuttle 104	UM – College Park Metro	8	8	12	8	20	20	20

Since no changes are anticipated to the bus network under the No Build alternative, it is not anticipated that current service levels would change substantially.

The No Build alternative would not include any alterations to the existing Metrobus, Ride On, or TheBus systems. It would not include addition of a new mode or new exclusive right-of-way, and therefore is not anticipated to substantially increase the reliability of the existing transit system. It is expected that increasing roadway congestion will result in lengthened bus running times and longer travel times for all vehicles and continue to decrease the reliability of the bus service, its adherence to its operational schedule, and the predictability of expected headways and transit travel times.

3.1.2. TSM Alternative

The TSM alternative would include enhanced bus service in the corridor and a new through-route from Bethesda to New Carrollton replacing the existing J4 route and adding service on portions of the F4/F6 routes between College Park and New Carrollton. The TSM bus service would consist of a limited-stop bus route that would make stops consistent with those of the Build alternatives. The core service improvements under the TSM alternative include limited-stop bus service, selected intersection and signal preference strategies, and upgrades to bus stop amenities. See Chapter 2 for a more detailed description of the TSM alternative.

A principal difference between the TSM and the Build alternatives is that the TSM service would operate on East West Highway between Bethesda and Silver Spring, rather than along a new guideway along the Georgetown Branch and Metropolitan Branch railroad rights-of-way between Bethesda and Silver Spring, as with the Build alternatives (except Low Investment BRT, which runs along Jones Bridge Road.) Along East West Highway, stops would be located at Connecticut Avenue and at Grubb Road.

The TSM service would provide faster one-seat rides between activity centers, including Medical Center Metro Station, Bethesda Metro Station, Silver Spring Transit Center, Takoma/Langley Park Transit Center, University of Maryland, College Park Metro Station, and New Carrollton Metro Station. This route would also serve transfers to bus routes operating on radial streets, including those on Wisconsin Avenue, Connecticut Avenue, Colesville Road, Georgia Avenue, New Hampshire Avenue, Riggs Road, Adelphi Road, US 1, Kenilworth Avenue, and Annapolis Road. It would serve the long-haul trips now carried by WMATA J2/J3, Ride On 15, and, to a degree, WMATA C2/C4, and it is estimated to serve nearly 80 percent of the passengers now boarding the routes named above.

Transit service to the National Naval Medical Center/National Institutes of Health area would be provided from Silver Spring and points east through the enhanced WMATA J1 service with intersection, operational, or service modifications. The Red Line Medical Center Station would continue to provide connectivity to the entire rail-bus network.

Because of the importance of serving the trips that interface with the Metrorail services in the Purple Line corridor, the TSM span of service would match the Metrorail span of service. The Metrorail system opens at 5 AM on weekdays and 7 AM on weekends. It operates until midnight Sunday through Thursday and until 3 AM on Fridays and Saturdays.

The fare structure for the TSM service would be the same as under the No Build alternative, recognizing that fares would increase over time. SmartCard, or some other means of electronic fare collection, may enable an integrated fare structure and convenient transfer with other transit services in the corridors.

End-to-end, the TSM route is 16 miles long, requiring about 108 minutes of running time with an average round trip speed of 9 miles per hour. Today, the bus routes along the alignment operate in very difficult circumstances with a wide range of times in each direction and between the AM and PM. Anecdotal reports from WMATA indicate that the J4 route often requires 50 percent more time than is scheduled on certain runs to complete its trip. These conditions complicate schedule preparation and operations planning. It is assumed TSM measures would somewhat mitigate these conditions; however, 2030 background traffic volumes and traffic congestion levels will be far greater than they are today.

The TSM alternative includes modifications to existing Metrobus routes intended to improve reliability, including limited-stop bus service, and intersection improvements and signal priority at certain intersections. At intersections where queue jump lanes and signal priority would be implemented, transit's reliability would increase because the effects of congestion at these locations would be reduced. In addition, the limited-stop service would provide faster connections between major origins and destinations, as well as providing one-seat rides.

However, there is only limited opportunity for improving transit service reliability using signal preference strategies in the corridor. The major radial roadways that cross the corridor, such as Connecticut Avenue, Georgia Avenue, New Hampshire Avenue, Riggs Road, Adelphi Road, US 1, Kenilworth Avenue, and Annapolis Road, are the major sources of delay and unreliability. These arterial roadways carry very heavy traffic flows into and out of Washington, DC and other activity centers. There is very little opportunity to introduce signal preferences at these intersections without causing a major exacerbation of traffic congestion. Queue jump lanes, however, do provide a travel time reliability advantage enabling transit vehicles to get to the intersection and limit the delay to one or two traffic signal cycles.

Table 3-3: TSM Bus Headways (minutes)

Route	Terminal and Intermediate Points	Early Morning	AM Peak	Midday	PM Peak	Evening	Weekend
TSM	Bethesda – New Carrollton	10	6	10	6	10	20
WMATA J1	Medical Center – Silver Spring	--	20	--	20	--	--
WMATA J3	Eliminate; replace with Ride On 15 service	--	--	--	--	--	--
WMATA C2	Terminate at Langley Park Langley Park – Greenbelt	30	15	20	15	30	30
WMATA C4	Twinbrook Metro – Prince George's Plaza Metro	10	8	15	8	20	20
WMATA F4	Silver Spring – New Carrollton	12	10	30	10	--	30
WMATA F6	Terminate at Prince George's Plaza Prince George's Plaza – New Carrollton	--	15	30	15	--	--
Ride On 15	Bethesda – Langley Park (extend to Bethesda)	15	15	15	15	30	15
TheBus 17	Langley Park–UM–College Park Metro	45	45	45	45	--	--

3.1.3. Build Alternatives

Six Build alternatives are under consideration. They include two transit modes, BRT and LRT. Each mode is being analyzed with three potential levels of investment: low, medium, and high. All of the Build alternatives would extend the full length of the corridor between the Bethesda Metro Station and the New Carrollton Metro Station with some variations in alignment location, type of running way (shared, dedicated, or exclusive), and amount of grade separation. The decision to construct dedicated lanes is dependent on the results of the operations modeling (which assumes no dedicated lanes), as well as construction costs and potential environmental benefits and impacts. Each of the Build alternatives is described briefly below and in greater detail in Chapter 2, *Alternatives Considered.*

Alternative 3 - Low Investment BRT

Low Investment BRT would primarily use existing streets to minimize capital costs. It would incorporate improvements to traffic signals (including signal priority where possible), signage, and travel lanes in appropriate areas. This alternative would mostly operate in mixed lanes, crossing all intersections at grade, and would include queue jump lanes at major intersections. Dedicated BRT lanes would be provided southbound along Kenilworth Avenue, and westbound along Annapolis Road. This is the only Build alternative that would operate on Jones Bridge Road (directly serving the National Institutes of Health and the National Naval Medical Center) and that would use the bus portion of the new Silver Spring Transit Center.

Alternative 4 - Medium Investment BRT

Medium Investment BRT is a composite of elements from the Low and High Investment BRT. Medium Investment BRT incorporates those lower-cost features for segments of Low Investment BRT that perform reasonably and those of High Investment BRT that provide reasonable benefits relative to the higher costs. The major incremental change for Medium Investment BRT is that between Bethesda and Silver Spring the transit service runs in a guideway in the Georgetown Branch right-of-way instead of along Jones Bridge Road. It would serve both the existing Bethesda bus terminal and the new south entrance to the Bethesda Metro Station beneath the Apex Building. At the Silver Spring Transit Center, the buses would enter on an aerial structure parallel to, but at a higher level than, the existing Metro and CSX tracks. Along University Boulevard the alternative would be in dedicated lanes and the alternative would leave Campus Drive in the University of Maryland at Regent's Drive to proceed directly through the East Campus development.

Alternative 5 - High Investment BRT

High Investment BRT is structured to provide the fastest travel time of the BRT alternatives. Tunnels and aerial structures are proposed at key locations to improve travel time and reduce delay. When operating within or adjacent to existing roads, this alternative would operate largely in dedicated traffic lanes. Like Medium Investment BRT, this alternative would serve the Bethesda Metro Station at both the bus terminal and the new south entrance. At the Silver Spring Transit Center, the buses would enter on an aerial structure parallel to, but at a higher level than, the existing Metro and CSX tracks.

Alternative 6 - Low Investment LRT

The terminal station for Low Investment LRT would be the Bethesda Metro Station with a connection to the southern end of the existing station platform (the LRT alternatives would only serve the south entrance of the Bethesda Metro Station and would operate there in a stub-end platform arrangement). It would operate in shared and dedicated lanes with minimal use of vertical grade separation and horizontal traffic separation. At the Silver Spring Transit Center, the light rail transit would enter on an aerial structure parallel to, but at a higher level than, the existing tracks.

This alternative would incorporate signal priority and/or queue jump lanes at major intersections, where possible to achieve substantial time savings or reliability without overly adversely affecting traffic at the intersections.

Alternative 7 - Medium Investment LRT

Medium Investment LRT is a composite of elements from Low and High Investment LRT. This alternative incorporates those lower cost features for segments of Low Investment LRT that perform reasonably and those of High Investment LRT that provide reasonable benefits relative to their higher costs. The principal incremental change for Medium Investment LRT is the introduction of several grade separations at major roadways and more dedicated sections along roadways; however, it does not include some of the longer tunnel sections in East Silver Spring, the University of Maryland, or Riverdale Park included under High Investment BRT and LRT.

Alternative 8 - High Investment LRT

High Investment LRT is nearly identical to High Investment BRT, except that it only serves the south entrance of the Bethesda Metro Station and would not serve the bus terminal.

Build alternatives Operations

The span of service for the Build alternatives would mirror that for the Metrorail system, including extended hours on weekend nights. See Table 3-4.

Table 3-4: Span of Service

Day of Week	Hours
Monday - Thursday	5:00 AM – 12:00 AM
Friday	5:00 AM – 3:00 AM
Saturday	7:00 AM – 3:00 AM
Sunday	7:00 AM – 12:00 AM

The headways of the various Build alternatives would vary by time of day to reflect demand requirements. Proposed headways are shown by time period in Table 3-5. The span of services of the bus routes that feed the TSM and Build alternatives would be adjusted to serve the market needing extended service times.

Table 3-5: Year 20303 Build Alternatives Headways (minutes)

Day of Week	Early AM	Peak	Midday	PM Peak	Evening	Late PM
Weekdays	10	6	10	6	10	10
Saturdays	20	N/A	10	N/A	10	20
Sundays	20	N/A	10	N/A	10	20

The fare for all of the Build alternatives under consideration would be consistent with the current local bus fare structure, recognizing that this would increase over time. SmartCard, or some other means of electronic fare collection, would enable an integrated fare structure and convenient transfer with the other transit services in the corridor.

The end-to-end travel times and average estimated speeds for each build alternative are shown in Table 3-6. As expected, High Investment LRT, with strategic grade separation and mostly dedicated or exclusive right-of-way, would have the shortest running time and the highest average speed of all the alternatives.

Table 3-6: Year 2030 End-to-End Travel Times

	End-to-End Running Time (minutes)	Average Speed (mph)
TSM	108	9
Low Investment BRT	96	10
Medium Investment BRT	73	13
High Investment BRT	59	16
Low Investment LRT	62	15
Medium Investment LRT	59	16
High Investment LRT	50	19

Average station-to-station travel time estimates for the Build alternatives are shown in Table 3-7.

The Medium Investment BRT variation via Jones Bridge Road would have an end-to-end running time of 76 minutes, which would result in an average speed of 13 mph. The other variation, Medium Investment BRT Extended to Medical Center, would have an end-to-end running time of 78 minutes, which would also result in an average speed of 13 mph. Under this latter variation, the time to downtown Bethesda, the larger travel market than Medical Center, would be 59 minutes compared to the 76 minutes via the Jones Bridge Road alignment.

Reliability

The overall reliability of any of the Build alternatives would be higher than that for the No Build or TSM alternatives because portions of the service, depending on the alternative, would operate in dedicated lanes or exclusive right-of-way, thus removing the vehicles from the potential delays of roadway congestion. In areas where the Purple Line would operate in shared lanes, it is anticipated that queue jump lanes and signal prioritization would be implemented where possible. The High Investment alternatives would have the highest reliability, and the Low Investment alternatives would have the lowest reliability. Because of the terminal configuration of High and Medium Investment BRT at Bethesda that involves a street-running loop, those two alternatives would not be as reliable as their LRT counterparts. Similarly, Low Investment BRT with its operations along Jones Bridge Road between Bethesda and Jones Mill Road would have lower reliability than Low Investment LRT, which would operate in the Georgetown Branch right-of-way, an exclusive right-of-way.

Table 3-7: Year 2030 Average Station-to-Station Travel Times (minutes)

Segment	TSM	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
Bethesda Metro, North entrance to Medical Center Metro	N/A	4.7	N/A	N/A	N/A	N/A	N/A
Bethesda Metro, North entrance to Bethesda Metro, South entrance	N/A	N/A	5.2	5.2	N/A	N/A	N/A
Medical Center Metro to Connecticut Avenue	N/A	6.0	N/A	N/A	N/A	N/A	N/A
Bethesda Metro, South entrance to Connecticut Avenue	10.8	N/A	5.5	5.5	4.0	2.4	2.4
Connecticut Avenue to Grubb Road	7.3	N/A	N/A	N/A	N/A	N/A	N/A
Connecticut Avenue to Lyttonsville	N/A	5.2	3.1	3.1	2.3	2.3	2.3
Grubb Road to Silver Spring Transit Center	13.2	N/A	N/A	N/A	N/A	N/A	N/A
Lyttonsville to Woodside/16th Street	N/A	2.4	2.4	2.4	2.1	2.1	2.1
Woodside/16th Street to Silver Spring Transit Center	N/A	6.2	2.1	2.1	2.8	2.0	2.0
Silver Spring Transit Center to Fenton Street	5.1	4.6	3.1	N/A	3.1	3.1	N/A
Silver Spring Transit Center to Dale Drive	N/A	N/A	N/A	2.6	N/A	N/A	3.6
Fenton Street to Dale Drive	4.8	2.8	3.0	N/A	3.8	3.1	N/A
Dale Drive to Manchester Road	2.9	2.3	2.3	2.1	3.1	2.8	2.4
Manchester Road to Arliss Street	4.9	4.8	4.7	1.4	1.4	1.4	1.4
Arliss Street to Gilbert Street	6.6	6.6	3.4	4.0	3.8	3.8	3.8
Gilbert Street to Takoma/Langley Transit Center	4.8	4.8	2.3	2.2	2.2	2.2	2.1
Takoma/Langley Transit Center to Riggs Road	5.8	5.6	2.7	1.7	2.4	2.4	1.7
Riggs Road to Adelphi Road	6.0	5.7	5.6	3.1	3.3	3.3	3.1
Adelphi Road to UM Campus Center	4.0	3.7	2.9	2.6	2.9	2.9	2.6
UM Campus Center to UM East Campus	8.6	8.6	3.0	2.9	3.0	3.0	2.9
UM East Campus to College Park Metro	2.0	2.2	3.0	3.0	3.0	3.0	3.0
College Park Metro to River Road	2.0	1.8	1.9	1.9	1.9	1.9	1.9
River Road to Riverdale Park	5.5	5.4	4.3	3.2	4.6	4.6	3.1
Riverdale Park to Riverdale Road	4.4	4.0	4.7	2.9	4.8	4.8	2.9
Riverdale Road to Annapolis Road	4.7	4.0	3.6	3.5	3.5	3.5	3.3
Annapolis Road to New Carrollton Metro	4.6	4.4	3.8	3.5	3.9	3.9	3.6
Total Running Time (rounded up to the nearest minute)	**108**	**96**	**73**	**59**	**62**	**59**	**50**

Note: Time represent average of morning and afternoon peak period travel times in the eastbound and westbound direction.

Ridership

Ridership forecasts are used to gauge the comparative attractiveness of alternatives under consideration. They are measured in terms of daily passengers and daily boardings, also called linked and unlinked trips. A passenger, or linked trip, is defined as travel from trip origin to trip

destination, regardless of the number of transfers or mode changes required. A boarding, or unlinked trip, is counted as the number of times a person enters a vehicle for travel, inclusive of transfers. One linked trip from origin to destination could comprise multiple unlinked trips.

Purple Line ridership forecasts were measured in terms of total and new daily transit trips (linked), peak period boardings and alightings by station, and by peak period line volumes.

Total and New Transit Trips

The Build alternatives would generate approximately a one percent increase in total regional transit ridership over the No Build alternative, while the TSM would generate approximately one half percent increase in total regional transit ridership. Detailed ridership forecasts are shown in Table 3-8. The results of the ridership modeling would indicate that forecast ridership on the Purple Line will not be the key determinant in selecting a preferred alternative, but rather the results of the environmental, traffic, and cost-benefit analyses.

District–to-District Travel Patterns

As discussed in Chapter 1, and shown in Figure 1-3 the Washington metropolitan area was defined as a set of districts to enable a discussion of the current travel patterns. A set of districts are defined around the major activity centers of Bethesda, Silver Spring, College Park, and New Carrollton in the corridor. Three additional districts are used to describe the "wedge" areas in between the major activity centers, Connecticut Avenue/Lyttonsville, Takoma Park/ Langley Park, and Riverdale Park. These seven districts constitute the Purple Line corridor. Other districts are used to define major sections of Washington, DC, and travel market areas around the Metrorail lines (both branches of the Red Line, Green Line, and Orange Line) running north and northeast of the corridor. The rest of the region is defined by larger districts for the remainder of Maryland and the areas of Virginia.

What this information shows is that while there is quite a bit of existing transit travel within the Purple Line corridor, there is a greater number of trips associated with areas outside the corridor, i.e., with Washington, DC and areas north along the Metrorail Red, Green, and Orange Lines, especially up toward the Shady Grove-Rockville area and the Glenmont area. While the major activity centers account for the majority of the trips, a substantial number of trips are associated with the wedge districts, those areas not presently served by Metrorail and dependent on street-running bus service operating in congested mixed traffic, are linked with either one of the major activity centers or other areas accessible via the Metrorail system, especially Washington, DC.

Referring to Table 3-9, by the year 2030 under the No Build, daily transit trips are forecast to grow by 953,000, 52 percent, for a total of 2,711,000.

Transit trips associated with the corridor grow by 38 percent, to 234,000, while trips within the corridor grow by 43 percent to 62,000 trips. While the general pattern and distribution of these transit trips would be similar to current trips, the level of growth is substantial, increasing the severity and the magnitude of the mobility needs of Purple Line corridor travelers.

The TSM alternative would increase daily total transit trips by 16,000 over the 2030 Future No Build. Of these new transit trips, 13,200, over 80 percent, are between the corridor and areas outside the corridor; while the other 2,800 trips are within the corridor. The TSM alternative provides most of the benefits to corridor trips to access the transit services that connect with the rest of the region; rather than travel among districts within the corridor.

All the Build alternatives have a similar pattern of change in the travel patterns, but because they have a similar alignment and station definitions and vary primarily by travel times, have different amount of new transit trips with High Investment LRT generating the highest number of new transit trips, and the Low Investment BRT generating the lowest.

Table 3-8: Year 2030 Total Daily Linked Transit Trips

	Type of Trip	No Build	TSM	Low Invest. BRT	Med. Invest. BRT	High Invest. BRT	Low Invest. LRT	Med. Invest. LRT	High Invest. LRT
Bus	Work	236,139	238,873	229,096	226,886	225,970	225,829	225,448	224,879
	Non-work	211,747	214,772	207,301	205,934	205,403	205,344	205,098	204,434
Metrorail	Work	561,114	560,040	558,148	558,299	557,668	558,423	558,377	558,446
	Non-work	298,451	300,917	300,909	301,583	301,852	302,331	302,523	303,011
Commuter Rail	Work and Non-work	47,944	48,983	48,922	48,937	48,984	48,934	48,930	48,956
Purple Line	Work	NA	NA	13,827	17,896	20,759	20,444	21,377	22,953
	Non-work	NA	NA	8,570	11,169	12,423	12,307	12,849	13,488
Total Transit Trips		**1,355,395**	**1,363,585**	**1,366,773**	**1,370,704**	**1,373,059**	**1,373,612**	**1,374,602**	**1,376,167**
New Transit Trips Relative to No Build (Rounded)		N/A	8,200	11,400	15,300	17,700	18,200	19,200	20,500

Table 3-9: Regional Transit Trips

	Existing 2000	2030 No Build	2030 TSM	2030 Representative Build Alternative
Trips Associated with Purple Line Corridor	169,000	234,000	302,000	334,000
Trips within Purple Line Corridor	44,000	62,000	65,000	75,000
Total Regional Trips	**1,778,000**	**2,711,000**	**2,727,000**	**2,749,000**

Daily Line Haul Boardings

Table 3-10 shows the total daily boardings for each of the alternatives. A boarding is when a person uses the transit service for all or part of trip. The boardings are shown for trips only using the Purple Line (over half the boardings), trips primarily on Metrorail and using the Purple Line for part of that trip, and trips primarily on MARC and using the Purple Line for part of that trip. High Investment LRT attracts the highest number of boardings followed by the other LRT alternatives and then the BRT alternatives.

The Medium Investment BRT variation via Jones Bridge Road, with the addition of the station at Woodmont Avenue and St. Elmo Street, would have total daily boardings of 50,000, while the other variation, Medium Investment BRT Extended to Medical Center, also including the station at Woodmont Avenue and St. Elmo Street, would have total daily boardings of 58,000. The Jones Bridge Road variation shows that the longer routing to the larger Bethesda travel market results in a loss of 2000 daily boardings relative to the original Medium Investment BRT alternative. The variation extending the service to Medical Center from Bethesda increases the daily boardings by 6,000.

Daily Station Boardings

Daily boardings, by station, for each of the Build alternatives are shown in Table 3-11. Not surprisingly given the shorter travel times, the highest number of riders is attracted by High Investment LRT, followed by Medium Investment LRT, and then Low Investment LRT and High Investment BRT, which attract approximately the same number of riders. All of the Build alternatives, except Low Investment BRT, have the same top three stations for daily boardings: the western terminus in Bethesda (north or south), the Silver Spring Transit Center, and the College Park Metro Station. For Low Investment BRT, the top three stations for daily boardings are the Silver Spring Transit Center, US 1 and College Park Metro Station.

Station Mode of Access

At all the stations along the Purple Line walk and feeder bus access would be the principal means of access and egress. At the Bethesda, Silver Spring, College Park, and New Carrollton Stations, transfer with Metrorail would be the major connection. With the exception of Bethesda, MARC connections are available at those stations. Major bus interfaces would occur at Bethesda, Silver Spring, Takoma/Langley, College Park, and New Carrollton stations. All these connections are with existing services. Some of the existing bus services would be modified to better integrate with the Purple Line service. Some existing bus services that duplicate the Purple Line service may be cut back. While parking facilities exist at the four Metrorail stations that connect with the Purple Line, no new park-and-ride facilities would be provided at any of the Purple Line stations. Kiss-and-ride could occur at some of stations, as occurs today at some bus stops, but additional kiss-and-ride facilities are being considered at Connecticut Avenue at the Georgetown Branch right-of-way, and at Lyttonsville.

University of Maryland Student Travel

The travel of University of Maryland employees, faculty, and staff to and from the campus is captured within the regional travel model forecasts and these trips are included in the

Table 3-10: Year 2030 Daily Purple Line Ridership

Transit Ridership (daily boardings)	TSM	Low Invest. BRT	Medium Invest. BRT	High Invest. BRT	Low Invest. LRT	Medium Invest. LRT	High Invest. LRT
Purple Line	12,700	22,200	29,300	33,800	32,500	33,900	36,100
Purple Line via Metrorail	2,100	16,700	21,100	23,700	25,300	27,200	30,500
Purple Line via MARC	--	1,100	1,400	1,400	1,500	1,500	1,500
Total	**14,800**	**40,000**	**51,800**	**58,900**	**59,300**	**62,600**	**68,100**

Table 3-11: Year 2030 Build Alternatives Daily Boardings

Segment	TSM	Low Inv. BRT	Med. Inv. BRT	High Inv BRT	Low Inv. LRT	Med. Inv. LRT	High Inv. LRT
Bethesda Metro, North Entrance	800	**1,400**	**5,600**	**6,000**	**N/A**	**N/A**	**N/A**
Medical Center Metro	N/A	**3,900**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Bethesda Metro, South Entrance	N/A	**N/A**	**2,800**	**3,000**	**11,300**	**12,700**	**13,300**
Montgomery Avenue	100	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Connecticut Avenue	100	**400**	**500**	**500**	**900**	**900**	**1000**
Grubb Road	500	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Lyttonsville	N/A	**600**	**700**	**700**	**800**	**800**	**900**
Woodside/16th Street	N/A	**1,400**	**2,000**	**2,500**	**2,200**	**2,300**	**2,400**
Silver Spring Transit Center	1,200	**5,100**	**8,700**	**10,400**	**11,100**	**12,200**	**13,600**
Fenton Street	600	**600**	**600**	**N/A**	**700**	**700**	**N/A**
Dale Drive	500	**1,200**	**1,300**	**1,400**	**1,300**	**1,400**	**1,500**
Manchester Place	600	**700**	**800**	**1,100**	**800**	**900**	**1,200**
Arliss Street	600	**800**	**900**	**1,700**	**1,300**	**1,500**	**2,200**
Gilbert Street	300	**300**	**900**	**1,300**	**1,200**	**1,200**	**1,400**
Takoma/Langley Transit Center	1300	**1,400**	**2,300**	**3,200**	**2,700**	**3,000**	**3,700**
Riggs Road	300	**400**	**600**	**800**	**700**	**800**	**900**
Adelphi Road	400	**500**	**600**	**700**	**600**	**700**	**700**
UM Campus Center	600	**1,500**	**2,100**	**2,200**	**2,100**	**2,200**	**2,200**
US 1 – East Campus	700	**4,400**	**4,400**	**4,700**	**4,500**	**4,500**	**4,700**
College Park Metro	**2,400**	**8,000**	**8,600**	**9,100**	**8,600**	**8,600**	**8,900**
River Road	500	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**	**1,500**
Riverdale Park	600	**1,400**	**1,500**	**1,600**	**1,600**	**1,500**	**1,600**
Riverdale Road	500	**500**	**500**	**700**	**600**	**500**	**700**
Annapolis Road	500	**900**	**1,100**	**1,200**	**1,000**	**1,000**	**1,200**
New Carrollton Metro	1,700	**3,100**	**3,800**	**4,500**	**3,800**	**3,700**	**4,500**
Total Boardings	**14,800**	40,000	51,800	58,800	59,300	62,600	68,100

forecasts for the Purple Line. Many of the 36,000 students live on campus or in nearby housing within walking distance of the campus. Others live off campus and commute to school. These trips are not as concentrated in the peak periods as employee trips and are not as regular, given that the University is not in full session over the summer and various break periods.

A portion of these commuting students would use the UM Shuttle, TheBus and WMATA bus services. The UM Shuttle provides connecting services to the College Park and Silver Spring Metro Stations. Many of these trips again occur outside the normal commuting peak periods – in evenings and on weekends.

The UM Shuttle provides a regular and relatively frequent service between the campus and the College Park Metrorail station throughout most of the day, carrying about 3,000 trips on a typical day. The service connecting with Silver Spring carries about 500 trips on a typical day. According to the Shuttle operator, approximately half of the users are students, or about 1,700 per day. With the Purple Line in place, these shuttle services would be discontinued or re-routed and these 1,700 would likely use the Purple Line. Some portion of these trips is likely already included in the regional model forecasts. As noted earlier, the University faculty and staff are fully accounted for by the regional forecasting model. For the purposes of the comparison of the alternatives, the analysis assumes that these trips are included in the regional forecasts and would be similar across all the alternatives.

Future travel forecast to be developed for the Locally Preferred Alternative, once selected, will include a separate student trip purpose forecast.

Special Event and Special Generator Trips

Venues such as sport stadiums and arenas and events, such as festivals or holiday fireworks displays, generate trips that may not be included in the regional travel forecasting process. Washington, DC is site of many of special events and special generators that occur with enough regularity and frequency that these are included in the regional model forecasts. Special events and generators within the corridor are not included in the regional forecasts. The principal special event and special trip generator venue is the University of Maryland campus in College Park, with Byrd Stadium, Comcast Center, and Clarice Smith Performing Arts Center. Byrd Stadium seats 50,000 people and hosts five to seven home weekend football games annually. The UM Shuttle carries a total of 2,000 to 3,000 trips (i.e., 1,000 to 1,500 individuals) for each game. This would mean that between 2 and 3 percent of the total attendance uses the Shuttle. For basketball, soccer, lacrosse, field hockey, and events at the Clarice Smith Performing Arts Center, Shuttle ridership is relatively low. While the University of Maryland does not have actual records, on an annual basis the total number of special event and special generator trips on the Shuttle is between 40,000 and 50,000. Not all these trips would be candidates for the Purple Line; however, the Purple Line could make using transit for these types of trips associated with the University of Maryland more attractive, especially if the Purple Line is on Campus Drive.

Most of these trips will be outside the normal weekday peak period, being on weekday evenings and on weekends. Averaging out over a typical weekday, these trips would represent about 170 trips, which is less than one percent of the daily usage of the Purple Line alternatives. So, while the Purple Line would provide an improved and attractive means of accessing the events at the University of Maryland and other venues, the amount will be a relatively small compared to the total usage.

Transportation System User Benefits

Transportation system user benefit is a measure of benefits that would accrue to users of the transportation system as a result of implementing an alternative. The users include both existing system users such as existing transit riders who might benefit from a faster trip or more convenient access to the service, as well as new transit users. These benefits include both time and monetary costs and are expressed in terms of minutes saved. The user benefit is calculated within the region's mode choice model for all alternatives and uses a measure of the traveler's value of time to convert monetary and other costs to their equivalence in time, which is added to actual time savings. In this way, the measure includes a more comprehensive accounting of the total costs of travel.

Table 3-12 shows the total user benefits for TSM and each of the Build alternatives. As the table shows, TSM would generate more than 400,000 minutes of user benefit (about 6,700 hours) to travelers in the Washington metropolitan area each day. All of the Build alternatives would generate higher user benefits than the TSM. Low Investment BRT would offer 55 percent more user benefits than TSM, while High Investment LRT would generate twice the user benefits of TSM.

Additional user benefits can accrue to users of fixed guideway transit services due to attributes of these systems not reflected strictly in terms of travel times and out-of-pocket costs. These are referred to as "mode specific attributes" and account for perceived benefits that users feel they receive for amenity, comfort, reliability, safety and other characteristics associated with the mode. The degree to which these additional benefits accrue to the users depends on the definitions of the alternatives. These would accrue to all the Build alternative users to varying degrees, depending on the specific attributes of the alternative. Table 3-13 shows the user benefits with the mode specific attributes included.

Mode-Specific Attributes

These attributes account for perceived benefits that users feel they receive for amenities, comfort, reliability, safety and other characteristics of the mode.

The Medium Investment BRT variation via the Jones Bridge Road, with the addition of the station at Woodmont Avenue and St. Elmo Street, would generate daily user benefits of 976,000 minutes in the year 2030 with the mode specific attributes included, which would be approximately a 575,000-minute daily increase over the TSM alternative but approximately 46,000 minutes daily less than the original Medium Investment BRT alternative. The other variation, Medium Investment BRT Extended to

Table 3-12: Year 2030 Daily Transportation System User Benefits by Alternative

	Daily User Benefits (minutes)	Increase in Daily User Benefits over TSM (minutes)	Percent over TSM
TSM	401,200	--	--
Low Investment BRT	623,700	222,500	55%
Medium Investment BRT	851,200	450,000	112%
High Investment BRT	994,200	593,000	148%
Low Investment LRT	1,033,700	632,500	158%
Medium Investment LRT	1,098,200	696,000	174%
High Investment LRT	1,211,800	810,600	202%

Table 3-13: Year 2030 Daily Transportation System User Benefits with Mode Specific Attributes

	Daily User Benefits (minutes)	Increase in Daily User Benefits over TSM (minutes)	Percent over TSM
TSM	401,200	--	--
Low Investment BRT	702,300	301,100	75%
Medium Investment BRT	1,022,200	621,000	155%
High Investment BRT	1,258,000	856,800	214%
Low Investment LRT	1,180,600	779,400	194%
Medium Investment LRT	1,303,800	902,600	225%
High Investment LRT	1,489,600	1,088,400	271%

Medical Center with the addition of the station at Woodmont Avenue and St. Elmo Street, would generate daily user benefits of 1,070,000 minutes in the year 2030 with the mode specific attributes included, which would be approximately a 669,000-minute daily increase over the TSM alternative and an approximate 48,000 minutes daily increase over the original Medium Investment BRT. This indicates the travel time benefits of serving the major Bethesda market directly while also providing a one-seat ride to the Medical Center area.

Farebox Revenue

Farebox revenues are the fares collected from passengers using the transit services for making trips. People use a variety of means to pay fares, including cash, tokens, passes, and electronic farecards. Passes and farecards for multi-trip, or weekly and monthly periods are typically purchased at a discount. Fare revenues include both fares at the initial boarding of the trip as well any transfer costs. The Purple Line corridor has a number of transit operators including WMATA, MARC, Ride On, and TheBus. For the purposes of this analysis, the operator of the Purple Line would be the MTA.

With the increase in systemwide transit users forecasted for the alternatives, the increase in systemwide farebox revenues relative to the 2030 No Build are presented in Table 3-14.

Table 3-14: Annual Change in Systemwide Farebox Revenues by Alternative Relative to 2030 No Build

TSM	$3,423,000
Low Investment BRT	$5,829,000
Medium Investment BRT	$7,500,000
High Investment BRT	$8,452,000
Low Investment LRT	$8,921,000
Medium Investment LRT	$9,356,000
High Investment LRT	$10,167,000

3.2. Highways and Roadways

3.2.1. Regional Effects on Travel and Congestion

The Build alternatives have the potential to slightly reduce traffic congestion and slightly improve regional air quality by prompting a shift in the mode of travel from private automobiles to public transit, either with BRT or LRT.

The potential regional traffic benefits of both the TSM alternative and the six Build alternatives were evaluated based on the change in daily vehicle trips, vehicle miles traveled (VMT), vehicle hours traveled (VHT), highway operating speeds, intersection levels-of-service (LOS), and representative travel times.

The results of these analyses are presented in the following discussion and in Table 3-15. The regional travel demand model, developed under the auspices of MWCOG, was used to generate the data. This data represents daily trips and vehicle miles traveled for the entire region contained in the MWCOG model.

Vehicle Trips

In a travel demand model, a vehicle trip represents a vehicle traveling from a unique origin to a unique destination; a tabulation of the total vehicle trips account for neither the number of passengers in a vehicle nor the length of the trip.

The Purple Line would operate in a built-out urban area, and station locations were selected to maximize walk and bus transfer access. Additionally, no new park-and-ride facilities and only limited formal kiss-and-ride facilities are being proposed as part of the TSM and Build alternatives. Therefore, it is expected that the change in vehicle trips would provide the most complete representation of the overall change in automobile usage. Each trip removed from the network is one less automobile traveling through the corridor each day.

For this project, the total number of vehicle trips in 2030 would decrease from 25,806,975 to 25,803,544 (-3,421 trips) from the No Build alternative to the TSM alternative. Low, Medium, and High Investment BRT would further decrease the total number of vehicle trips compared to the No Build alternative, by 11,005;

Table 3-15: Year 2030 Regional Travel Impacts

	Daily Vehicle Trips	Daily VMT
No Build	25,806,975	261,054,037
TSM	25,803,554	261,040,445
Change over No Build	-3,421	-13,592
% Change over No Build	-0.013%	-0.005%
Low Investment BRT	25,795,970	261,001,838
Change over No Build	-11,005	-52,199
% Change over No Build	-0.043%	-0.020%
Medium Investment BRT	25,792,838	260,940,475
Change over No Build	-14,137	-113,562
% Change over No Build	-0.055%	-0.044%
High Investment BRT	25,790,959	260,878,947
Change over No Build	-16,016	-175,090
% Change over No Build	-0.062%	-0.067%
Low Investment LRT	25,790,505	260,886,581
Change over No Build	-16,470	-167,456
% Change over No Build	-0.064%	-0.064%
Medium Investment LRT	25,789,722	260,870,434
Change over No Build	-17,253	-183,603
% Change over No Build	-0.067%	-0.070%
High Investment LRT	25,788,222	260,867,637
Change over No Build	-18,753	-186,400
% Change over No Build	-0.073%	-0.071%

14,137; and 16,016 trips, respectively. Low, Medium, and High Investment LRT would result in a slightly larger decrease in total vehicle trips than the BRT Alternatives. Low, Medium, and High Investment LRT would decrease total daily vehicle trips by 16,470; 17,253; and 18,753 trips, respectively, compared to the No Build alternative. The reduction in daily vehicle trips under the various Build alternatives represents changes in magnitude of 0.04 to 0.07 percent relative to the No Build alternative.

The change in vehicle trips was further broken down into the nineteen districts shown in Figure 1-3. This analysis provides additional insight into the expected reduction in total automobile trips in the areas immediately surrounding the Purple Line corridor. Table 3-16 indicates the total reduction in automobile trips relative to the No Build alternative, both into and out of, each of the nineteen districts for each of the six Build alternatives.

The results in Table 3-16 indicate that the LRT alternatives generally result in a greater reduction in automobile trips than the BRT alternatives in the various districts. The table shows that the change in automobile travel is expected to be greatest in the districts that surround the Purple Line corridor. The largest change in automobile traffic is expected in the College Park district, with a net decrease in automobile trips between 5,500 and 7,100 per day. The Silver Spring district is expected to see a net decrease in automobile trips between 2,800 and 5,900 per day. The Build alternatives are also expected to reduce the number of trips made by automobile in the Bethesda (900 to 4,300 trips per day), Takoma-Langley (1,300 to 3,900 trips per day), Riverdale Park (2,400 to 2,900 trips per day), Connecticut-Lyttonsville (1,000 to 1,300 trips per day), and New Carrollton (1,000 to 1,500 trips per day) districts, which also directly adjoin the Purple Line.

Table 3-16: Year 2030 Reduction in Automobile Trips by District Compared to No Build

District	Low Invest. BRT	Medium Invest. BRT	High Invest. BRT	Low Invest. LRT	Medium Invest. LRT	High Invest. LRT
Bethesda	892	1,989	2,165	3,745	4,150	4,314
Connecticut - Lyttonsville	999	998	1,035	1,195	1,278	1,283
Silver Spring	2,777	4,306	4,938	5,152	5,627	5,864
Takoma - Langley	1,251	2,432	3,388	2,986	3,285	3,850
College Park	5,522	6,346	6,927	6,540	6,601	7,092
Riverdale Park	2,446	2,605	2,890	2,675	2,640	2,949
New Carrollton	1,041	1,218	1,501	1,283	1,236	1,544
Shady Grove	1,026	1,333	1,494	1,775	1,994	2,150
Glenmont	498	926	1,041	1,257	1,377	1,482
Greenbelt	723	859	1,020	917	940	1,075
Washington DC (All 4 Districts)*	2,172	2,754	3,306	3,277	3,447	3,946
Southwest Montgomery County	116	389	473	524	620	707
North	962	1,717	1,947	2,147	2,308	2,515
South	949	1,083	1,206	1,193	1,204	1,308
East	1,240	1,492	1,803	1,561	1,510	1,850
West	88	121	150	125	133	151

* The four districts comprising Washington, DC have been combined.

Note that all the values in Table 3-16 represent trips which start or end in these particular districts; it is reasonable to expect that the actual reduction in automobile trips within a particular district would be higher due to a reduction in trips passing through the district. For example, a trip from Bethesda to Silver Spring is represented in the Bethesda and Silver Spring values; however, there is a high likelihood such a trip would pass through the Connecticut-Lyttonsville district, further reducing the number of cars on the road in that area.

A measurable reduction in automobile trips is also projected for districts that do not directly adjoin the Purple Line corridor; this trend is most pronounced in those districts that are served by a direct Metrorail connection. Within the Shady Grove district (served by the Red Line), automobile trips are projected to decrease between 1,000 and 2,200 per day, depending on the Build alternative. Similarly, the Glenmont (Red Line) and Greenbelt (Green Line) districts are projected to see decreases in automobile trips. A substantial reduction in automobile trips (between 2,200 and 3,900) is also projected within Washington, DC.

Vehicle Miles Traveled (VMT)

A second parameter that can be used to evaluate the impact of transit alternatives on overall automobile usage is the overall VMT in the region. Vehicle miles represent the total miles traveled during all of the vehicle trips within a region, without regard to the number of passengers in a vehicle.

In 2030, under the No Build alternative, a total of 261,054,037 vehicle miles would be traveled each day in the Washington metropolitan area. Under the TSM alternative, that total would be decreased slightly by 13,592 vehicle miles. Under Low Investment BRT, the total VMT is projected to decrease by 52,199 vehicle miles compared to the No Build alternative. Under Medium Investment BRT, the total VMT is projected to decrease by 113,562 relative to the No Build alternative, and under High Investment BRT the total VMT would be reduced by 175,090 vehicle miles relative to the No Build alternative. Low Investment LRT (-167,456 vehicle miles), Medium Investment LRT (-183,603 vehicle miles), and High Investment LRT (-186,400 vehicle miles) would also decrease total daily VMT, relative to the No Build alternative.

For transit facilities with park-and-ride and kiss-and-ride facilities at many of the stops, the reduction in vehicle trips is often combined with a more substantial reduction (on a percentage basis) in total VMT. This trend occurs because not only do vehicle trips decrease, but some portion of the remaining vehicle trips are shortened as people drive to a transit stop and then transfer to transit for the remainder of their trip. Given the few kiss-and-ride and park-and-ride facilities associated with the TSM and Build alternatives, the daily VMT results could provide a skewed picture of the impacts of the Purple Line on automobile traffic. The vehicle trip data indicate that there is a small, but measurable, decrease in the number of daily vehicle trips associated with each alternative. Due to this reduction in vehicle trips, levels of congestion may slightly decrease on particular routes, which may lead to some of the remaining vehicle trips selecting routes that are longer in terms of distance (more vehicle miles traveled).

Roadway Operating Speeds

The average roadway speed represents the operating speeds in the region. For some projects, this can be used as a measure of the reduction in traffic congestion. However, given the small magnitude of the reduction in total

daily vehicle trips for the Build alternatives, the change in the average roadway speeds is projected to be quite small. For this project, the average roadway speed in 2030 under the No Build alternative is 24.5 mph. There would be no measurable increase in the regional average roadway speeds under any of the Build alternatives.

Levels of Service on Key Highway Links

For this project, detailed peak hour traffic analyses were conducted for numerous signalized intersections along the roadways that the Purple Line would run parallel to or cross at grade. For the purposes of these traffic analyses, the 2030 volume forecasts assumed that there would be no change in these peak-hour volumes between the No Build, TSM, and Build alternatives. As was discussed earlier, there are reductions in vehicle trips projected for the TSM and Build alternatives, so this assumption is sufficiently conservative. However, due to this assumption of constant traffic volumes between the No Build and Build alternatives, a comparison of the level of service on a link basis was not expected to reveal measurable differences among the various alternatives. Instead, a comparison of the levels of service of signalized intersections in the corridor was developed.

3.2.2. Corridor Impacts of Alternatives and Operations

According to the 2030 CLRP, very few major capacity improvements are planned for the existing roadway network in the corridor. In fact, the two most notable improvements: the widening of Kenilworth Avenue from River Road north to Pontiac Street from four lanes to six lanes, and the widening of US 1 from I-95 south to College Avenue from four lanes to six lanes, are on north-south routes that would not directly compete with the east-west travel service provided by the Purple Line. In the case of Kenilworth Avenue, the section to be widened is beyond the immediate vicinity of the Purple Line. Nonetheless, these improvements were included in the roadway networks for the No Build, TSM, and Build alternatives.

No Build Alternative

The No Build alternative includes several improvements to the roadway system that have been approved independently of the Purple Line as of 2007. Design year traffic analyses for these locations assumed these improvements would be in place. These projects include, but are not limited to, the following:

- Intersection improvements at University Boulevard and New Hampshire Avenue to include a second northbound left turn from New Hampshire Avenue to westbound University Boulevard (currently under construction)
- Intersection improvements at University Boulevard and Riggs Road to include a second westbound left-turn lane and third eastbound through lane on University Boulevard (funded for Preliminary Engineering only)
- Intersection modifications at Colesville Road and 2nd Avenue to remove the existing northbound left-turn lane with traffic re-routed via East West Highway, 16th Street, Spring Street, and 2nd Avenue.

TSM Alternative

The TSM alternative includes the operation of an enhanced bus system, which would incorporate transit signal priority measures at various signalized intersections along the corridor and selected use of right-turn lanes as queue by-pass lanes to improve transit time. East of the Silver Spring, the TSM trunk line bus service would run in operating environments comparable with Low Investment BRT described below. West of Silver Spring, the primary TSM service would operate largely along East West Highway where there is no opportunity for queue jump lanes or other geometric changes without substantial capital costs or property impacts. The TSM alternative assumes no major geometric changes to the intersections under analysis, beyond those discussed for the No Build alternative.

Build Alternatives

The AA/DEIS includes the analysis of six Build alternatives for the Purple Line. These alternatives are differentiated by the two transit modes being considered, BRT and LRT, as well as by three levels of capital investment, Low, Medium, and High. In general, the Build alternatives follow the same route and would require modifications to the existing roadway network to construct and operate a transit service. The Build alternatives differ in the extent of the roadway widening required in various segments (based on operations in dedicated transit lanes or in shared lanes in mixed traffic), the provision of grade separation at key junctions, and the modifications required to existing traffic signals to accommodate the BRT or LRT movements. The following section summarizes the various physical modifications intended to improve the speed and reliability of the transit service, minimize impacts to automobile traffic, and increase pedestrian and vehicle safety that would be associated with each of the Build alternatives. These modifications were included in the traffic analyses for each alternative.

Highway and roadway effects of the Medium Investment BRT variation along Jones Bridge Road are covered by the discussions relative to the original Medium Investment BRT alternative east of Jones Mill Road and generally by the discussions relative to Low Investment BRT west of Jones Bridge Road. The Medium BRT Extended to Medical Center variation is covered by the discussions of the original Medium Investment BRT between New Carrollton and Bethesda plus the discussion of Low Investment BRT for the section between the Bethesda Metro Station (north entrance) and the Medical Center along Woodmont Avenue and Wisconsin Avenue/Rockville Pike.

Bethesda Metro to Silver Spring Metro

Starting from the west, the Build alternatives would all originate at a connection with the existing Bethesda Metro Station, located on the Red Line.

Low Investment BRT would begin at the existing Bethesda bus loop on Edgemoor Lane and then enter mixed traffic in the existing travel lanes on Old Georgetown Road along Woodmont Avenue. Approaching Wisconsin Avenue along Woodmont Avenue, Low Investment BRT would turn onto a new parallel alignment, west of Wisconsin Avenue, in front of the National Institutes of Health (NIH). This alternative would then use the existing traffic signal, which would be modified to include a new signal phase to serve BRT movements, at the intersection of Wisconsin Avenue and Jones Bridge Road to turn onto Jones Bridge Road. At that intersection, a queue jump lane would be provided for westbound BRT vehicles to bypass traffic waiting to turn onto Wisconsin Avenue. The Low Investment BRT would then continue east along Jones Bridge in mixed traffic, using the existing travel lanes and passing through the signalized intersections of Glenbrook Parkway, Grier Road, and Platt Ridge Road. At the intersection of Connecticut Avenue and Jones Bridge Road, a queue jump lane would be provided for westbound BRT. The alternative would then continue east along Jones Bridge Road, passing through the signalized intersection at Manor Road in mixed traffic in the existing travel lanes. An eastbound queue jump lane would be provided at the intersection with Jones

Mill Road to allow BRT to turn right onto Jones Mill Road. The alignment would then immediately turn east onto the Georgetown Branch right-of-way and enter Rock Creek Park, where it would tie into the alignment followed by the remaining alternatives.

The remaining five Build alternatives would follow an alternate route between Bethesda Metro Station and Rock Creek Park. The Medium and High Investment BRT Alternatives would follow a one-way loop in downtown Bethesda from the Georgetown Branch right-of-way onto Pearl Street in the existing travel lanes, then west along East West Highway and Old Georgetown Road in the existing travel lanes, through the existing bus terminal on Edgemoor Road, south along Woodmont Avenue, and then turn back east under the Air Rights building to rejoin the Georgetown Branch right-of-way. All five of the remaining alternatives would then follow the Georgetown Branch right-of-way, operating in an exclusive transit right-of-way adjacent to a new permanent hiker-biker trail, cross under East West Highway, and continue east toward Connecticut Avenue. Low Investment LRT would include an at-grade crossing of Connecticut Avenue; this would be accomplished by adding a new exclusive signal phase to serve LRT movements at the intersection of Connecticut Avenue and Chevy Chase Lakes Drive. The remaining four Build alternatives would cross Connecticut Avenue on an aerial structure with the hiker-biker trail also crossing on a separate bridge. All five alternatives then continue east, crossing under Jones Mill Road along the Georgetown Branch right-of-way and entering Rock Creek Park.

From Rock Creek Park, all six Build alternatives continue toward the east along the Georgetown Branch right-of-way. The alternatives would cross under Lyttonsville Place, crossing Stewart Avenue at grade, and then turn and run parallel to the existing CSX railroad tracks; the Build alternatives would be located on the south side of the CSX tracks. The alternatives would continue east along the CSX tracks crossing 16th Street and Spring Street. Low and Medium Investment BRT, and Low Investment LRT, would cross 16th Street and Spring Street at grade. This crossing would be accomplished by the installation of new traffic signals on 16th Street and Spring Street to accommodate crossings of the transit vehicles. Medium and High Investment LRT, and High Investment BRT would cross both 16th Street and Spring Street below the existing street levels.

At Spring Street, Low Investment BRT would turn north from the CSX tracks and follow Spring Street in mixed traffic in the existing travel lanes, and then turn east onto Second Avenue, continuing to operate in mixed traffic in the existing travel lanes before crossing Colesville Road at the existing signalized intersection at grade. Low Investment BRT would then continue briefly on Wayne Avenue before turning right onto Ramsey Street and accessing the Silver Spring Transit Center, which is being constructed on the site of the existing Red Line Silver Spring Metro Station.

From Spring Street, the remaining five Build alternatives would continue along the south side of the CSX tracks before crossing the tracks on an aerial structure into the Silver Spring Transit Center.

Silver Spring Metro to College Park Metro

From the Silver Spring Transit Center, each of the Build alternatives would use one of three different routes to connect to Wayne Avenue and continue eastward.

Low Investment BRT would exit the Silver Spring Transit Center back onto Ramsey Street and then turn right onto Wayne Avenue. This alternative would continue east, in mixed traffic within the existing travel lanes, crossing Dixon Street, Georgia Avenue, Fenton Street, and Cedar Street at the existing traffic signals. This alternative would then continue east along Wayne Avenue, operating in mixed traffic within the existing travel lanes, passing through the signalized intersections of Dale Drive, Mansfield Road, and Sligo Creek Parkway. The alignment would then continue east along Wayne Avenue and up a steep grade to the signalized intersection at Flower Avenue. Low Investment BRT would then turn right onto Flower Avenue followed by an immediate left onto Arliss Street at the existing unsignalized intersection. Continuing to operate in mixed traffic within the existing travel lanes, Low Investment BRT would then turn left onto Piney Branch Road and then right onto University Boulevard. Low Investment BRT would continue east along University Boulevard in shared lanes, passing through numerous existing traffic signals, before turning onto Campus Drive, crossing Adelphi Road, and entering the campus of the University of Maryland. Low Investment BRT would operate in mixed traffic throughout the campus. From Campus Drive, the alignment would turn left along Presidents Drive to Union Lane, and return to Campus Drive near Cole Field House. Low Investment BRT would continue along Campus Drive, pass through the roundabout at Regents Drive, and continue toward US 1. This alternative would cross US 1 at grade, using the existing traffic signal at Campus Drive and Paint Branch Parkway. After crossing US 1, Low Investment BRT would turn east onto Paint Branch Parkway where it would tie into the alignment of the remaining Build alternatives.

High Investment BRT and LRT would exit the Silver Spring Transit Center and continue south along the CSX tracks before entering a tunnel section in the vicinity of Silver Spring Avenue. This tunnel section would curve to the north under Grove Street, and High Investment BRT and LRT would return to grade along Wayne Avenue between Cedar Street and Dale Drive. To accommodate the tunnel portal on Wayne Avenue and provide a higher level of transit service, Wayne Avenue would be reduced from two to one travel lane in each direction. The second existing travel lane would be converted to transit-only use. New eastbound and westbound left-turn lanes would be provided at the existing traffic signal at Dale Drive and the westbound left-turn movement at the signalized intersection at Mansfield Road would be restricted and that traffic would be re-routed to the intersection at Dale Drive. A new eastbound left-turn lane would be added at Sligo Creek Parkway. East of Sligo Creek Parkway, Wayne Avenue would be widened by two lanes to provide a dedicated transit lane in the median in each direction. At a point 900 feet east of Sligo Creek Parkway, High Investment BRT and LRT would turn from Wayne Avenue and enter a tunnel section beneath Plymouth Street. A new signal would be required along Wayne Avenue to allow transit vehicles to enter and exit the median of Wayne Avenue. The tunnel section would return to grade along Arliss Street, just east of Flower Avenue, where High Investment BRT and LRT would join with Low and Medium Investment LRT and Medium Investment BRT, and the five alternatives would continue eastward.

Low and Medium Investment LRT and Medium Investment BRT would exit the Silver Spring Transit Center and turn onto Bonifant Street where they would operate at grade in dedicated transit lanes on the north side of Bonifant Street. Under Medium Investment LRT, Bonifant Street, between Ramsey Street and Fenton Street, would be converted from two-way operation to one-way operation (either eastbound or westbound). On-street parking would remain along the south curb. The very low volume of westbound or eastbound traffic currently using Bonifant Street between Fenton Street and Georgia Avenue would be diverted to Thayer Avenue, one block

to the south. Some minor widening of Bonifant Street is expected between Ramsey Street and Georgia Avenue, where these alternatives would cross at grade using the existing traffic signal. The slight modification would accommodate the conversion of Bonifant Street to one-way operation. Under Low Investment LRT two-way traffic would be maintained on Bonifant Street between Georgia Avenue and Fenton Street; this would require the removal of on-street parking along the south curb of Bonifant Street.

Approaching Fenton Street, these alternatives would turn left and tie into the existing signalized intersection of Fenton Street and Wayne Avenue as a new approach. The traffic signal would be modified to incorporate a new signal phase to accommodate transit movements. Low and Medium Investment LRT and Medium Investment BRT would then continue east, passing through Cedar Street on Wayne Avenue. Wayne Avenue would be widened by one lane between Cedar Street and Fenton Street to accommodate an exclusive westbound left-turn lane for transit vehicles at Fenton Street and a new eastbound left-turn bay for automobile traffic at Cedar Street, under Medium Investment LRT. Under Low Investment LRT, an exclusive westbound left turn lane for transit vehicles would be provided at Fenton Street. Low Investment LRT would share the existing inside travel lane with left turning and through automobile traffic at Cedar Street.

LRT would function as a streetcar east of Cedar Street; the tracks for Low and Medium Investment LRT would be constructed in the existing inside travel lane in each direction along Wayne Avenue; two travel lanes would be maintained in each direction: the outside travel lanes would carry regular traffic and the inside travel lanes would carry mixed traffic (LRT and automobiles). Under Medium Investment LRT, at the existing signalized intersection at Dale Drive, a new left-turn lane for automobile traffic would be provided in the eastbound and westbound directions. If a station is provided to the east of Dale Drive, then a westbound left-turn lane would not be provided due to property impacts. Instead, a dedicated pedestrian pathway would be constructed in the median to allow pedestrians to safely access the station using the signalized crossings at Dale Drive. Under Low Investment LRT, the light-rail vehicles in both directions would share the inside travel lanes with left-turning and through traffic.

Continuing east, Low Investment LRT would continue through the signalized intersection at Sligo Creek Parkway in the existing travel lanes. Both eastbound and westbound LRT vehicles would share lanes with left turning traffic at Sligo Creek Parkway. For Medium Investment LRT new eastbound and westbound left turn lanes would be provided at Sligo Creek Parkway. East of Sligo Creek Parkway, Wayne Avenue would be widened by two lanes to provide two dedicated transit lanes in the median. At a point approximately 900 feet east of Sligo Creek Parkway, the Low and Medium Investment LRT would turn off of Wayne Avenue into a tunnel section beneath Plymouth Street. A new traffic signal would be required along Wayne Avenue at this location to permit light rail transit vehicles to enter and exit Wayne Avenue. The Low and Medium Investment LRT return to grade along Arliss Street, just east of Flower Avenue.

Meanwhile, Medium Investment BRT would continue along Wayne Avenue in the existing travel lanes, passing through the intersection with Sligo Creek Parkway, turning right onto Flower Avenue, and then left onto Arliss Street. At this point on Arliss Street, these three alternatives would join the High Investment BRT and High Investment LRT and all five of these remaining Build alternatives would continue eastward on generally the same alignment.

These five alternatives would turn left onto Piney Branch Road, which would be widened to accommodate one new dedicated transit lane in each direction; all the LRT Alternatives and High Investment BRT would operate in the median, while Medium Investment BRT would operate in the curb lanes, which would be shared with right-turning traffic along Piney Branch Road. The existing two-way left-turn lane between Arliss Street and Barron Street would be removed, and the unsignalized access points along this segment of Piney Branch Road would be converted to right-in / right-out access.

At University Boulevard, these five alternatives would turn right onto University Boulevard, which would be widened to accommodate one new dedicated transit lane in each direction. The LRT Alternatives and High Investment BRT would operate in a protected median section; while Medium Investment BRT would operate in the curb lanes, which would also accommodate right-turn movements. Along University Boulevard, for automobile traffic, the lane configurations at the signalized intersections would remain unchanged relative to the No Build alternative. For the LRT Alternatives and High Investment BRT, the signal phasing for the eastbound and westbound left turns at all signalized intersections would need to be converted to protected-only phasing due to the presence of the median-running transitway. A number of existing unsignalized median breaks along University Boulevard may need to be closed to automobile traffic; new traffic signals or active warning signing would also be considered at the remaining locations. The treatment of these unsignalized intersections would be addressed in greater detail during the Preliminary Engineering phase.

At the intersections of University Boulevard and New Hampshire Avenue, Riggs Road, and Adelphi Road, grade-separated crossings for transit vehicles would be provided for both High Investment LRT and BRT. These streets would be crossed at grade using the existing traffic signals for the remaining alternatives, with one exception: all LRT alternatives would have a below-grade crossing of Adelphi Road due to the steep grade.

After crossing Adelphi Road, these five alternatives would continue eastward through the University of Maryland campus. Medium Investment BRT and Low and Medium Investment LRT would follow the same general alignment as Low Investment BRT through Campus Drive until reaching the roundabout at Regents Drive. Under these options, however, Campus Drive would be closed to through vehicle traffic between Union Lane and the ‘M’ Circle (except for other transit vehicles, emergency services, and University service vehicles), consistent with the University’s Master Plan. Automobile traffic through campus would be re-routed to Paint Branch Drive, Regents Drive, and Stadium Drive. Under these three options, the Regents Drive roundabout would be re-configured into a pair of T-intersections. Medium Investment BRT and Low and Medium Investment LRT would turn slightly south and enter a new exclusive right-of-way through the parking lots adjacent to the Armory and on to Rossborough Lane.

After crossing Adelphi Road, High Investment BRT and High Investment LRT would continue into a full tunnel section beneath the center of the campus. These alternatives would return to grade in a new exclusive right-of-way to be constructed along the south side of the existing campus recreational fields through the parking lots adjacent to the Armory and on to Rossborough Lane.

This new exclusive right-of-way would intersect US 1 at grade as the fourth leg of the existing intersection of US 1 and Rossborough Lane, which would be maintained as part of the

proposed East Campus Development. All five of these alternatives would then continue through the East Campus Development, along Rossborough Lane, in dedicated transit lanes.

These five alternatives would then turn right onto Paint Branch Parkway, where the alignment would be joined by Low Investment BRT. All six alternatives would now continue east along Paint Branch Parkway.

For Low and Medium Investment BRT the transit vehicles would operate in mixed traffic within the existing travel lanes along Paint Branch Parkway before turning right onto River Road and accessing the station adjacent to the existing College Park Metro Station.

High Investment BRT and Low, Medium, and High Investment LRT would operate in mixed traffic before turning right onto an exclusive right-of-way through a proposed development at the existing College Park Metro Station. The existing traffic signal at the intersection of Paint Branch Parkway and the Metro parking garage would be modified to include an additional signal phase for westbound light rail transit vehicles to turn left onto Paint Branch Parkway.

College Park Metro to New Carrollton Metro

High Investment BRT and Low, Medium, and High Investment LRT would all operate in new exclusive right-of-way to be constructed on the south side of River Road. New traffic signals or gate arms would be provided at the unsignalized driveways along the south side of River Road to separate vehicle and pedestrian traffic from the movements of the transit vehicles.

High Investment LRT and BRT would turn from River Road, east of Rivertech Court, and enter a tunnel that would pass underneath an existing park and stream. This tunnel would return to grade in the median of East West Highway, just west of its existing signalized intersection with Kenilworth Avenue. These alternatives would cross Kenilworth Avenue at grade, using the existing signal phasing, and continue east along East West Highway in two new dedicated transit lanes constructed in the median. The existing turning lane would be maintained at the signalized intersections along East West Highway; however, the signal phasing would be modified along East West Highway to convert the eastbound and westbound left turns to protected-only movements. The existing overpasses at the Baltimore-Washington Parkway would be lengthened to accommodate dedicated lanes as part of High Investment BRT and LRT, which would continue east and then turn right into the median of Veterans Parkway. These alternatives would then continue east in new dedicated transit lanes constructed in the existing median of Veterans Parkway and pass under the existing signalized intersection of Veterans Parkway and Annapolis Road. High Investment BRT and LRT would then turn left from the median of Veterans Parkway onto Ellin Road; two new dedicated transit lanes would be constructed on the south side of Ellin Road. A new gate arm or traffic signal would be required at Hanson Oaks Court to separate automobile and transit movements at this unsignalized crossing. These alternatives would then terminate at the New Carrollton Metro Station.

After departing the Purple Line station adjacent to the College Park Metro Station, Low Investment BRT would operate in shared lanes along River Road. Low Investment BRT would then turn onto Kenilworth Avenue, which would be widened to provide one dedicated transit lane in the southbound direction. Northbound bus rapid transit vehicles under Low Investment BRT would operate in mixed traffic within the existing northbound lanes on Kenilworth Avenue. This alternative would then turn left onto East West Highway, where it would operate in mixed traffic within the existing travel lanes, and pass through the existing signalized intersections along the corridor. Continuing in mixed traffic operations, within the existing travel lanes, this alternative would then turn right onto Veterans Parkway. The alternative would then turn left onto Annapolis Road, where the eastbound bus rapid transit vehicles would operate in mixed traffic within the existing travel lanes before turning right onto Harkins Road; one new dedicated transit lane would be provided along Annapolis Road between Harkins Road and Veterans Parkway for westbound bus rapid transit vehicles. Low Investment BRT would continue on Harkins Road, operating in mixed traffic in the existing travel lanes, before terminating at the New Carrollton Metro Station.

Medium Investment BRT would also operate in mixed traffic along River Road. At the intersection of River Road and Kenilworth Avenue, Medium Investment BRT would use the existing traffic signal to turn into two newly constructed dedicated transit curb lanes (all widening of Kenilworth Avenue to accommodate these lanes would occur west of the existing western curb line) on Kenilworth Avenue. The signal phasing along northbound Kenilworth Avenue would be modified to eliminate potential conflicts between northbound through traffic and left-turning bus rapid transit vehicles. Medium Investment BRT would then continue south along Kenilworth Avenue, operating in the new transit-only curb lanes.

Medium Investment BRT would then turn left onto East West Highway and operate in two newly dedicated transit curb lanes. The turn from Kenilworth Avenue to East West Highway could be accommodated with minor adjustments to the signal phasing at the intersection and some minor geometric modifications (shifting of stop bars) to accommodate the turning radius of the bus rapid transit vehicle. Medium Investment BRT would continue east along East West Highway in dedicated transit lanes until reaching the diamond interchange at the Baltimore-Washington Parkway. At the existing signalized intersections of the northbound and southbound off-ramps, a new signal phase would be added to allow Medium Investment BRT to leave its dedicated transit lanes and enter the existing travel lanes beneath the Baltimore-Washington Parkway overpasses; thereby not requiring any lengthening of the overpasses. After clearing the overpasses, Medium Investment BRT would then re-enter two newly constructed dedicated transit lanes along the curb. Medium Investment BRT would then turn onto Veterans Parkway using the existing signal phasing and would operate in mixed traffic within the existing traffic lanes. Medium Investment BRT would then cross Annapolis Road at grade, using the existing traffic signal, and would continue to Ellin Road before using the existing traffic signal at Ellin Road to turn into two newly constructed dedicated transit lanes (all widening along Ellin Road would occur to the south of the existing curb line). Medium Investment BRT would then terminate at the New Carrollton Metro Station.

Low and Medium Investment LRT would exit the College Park Metro Station and continue in a new exclusive right-of-way parallel to and south of River Road. This exclusive right-of-way would turn and continue parallel to, and west of, Kenilworth Avenue. The tracks for Low and Medium Investment LRT would cross the western leg of the intersection of Rittenhouse Street at grade, making use of the existing traffic signal to provide time separation; the signal phasing at Rittenhouse Street would be modified to convert the northbound and southbound left turns to protected-only phasing. Two new gate arms would be required at Quesada Road and Quintana Street to prohibit unsignalized automobile movements when light rail vehicles are approaching.

Low and Medium Investment LRT would then turn left from Kenilworth Avenue into two dedicated transit lanes in the median of East West Highway. To accommodate these two dedicated median transit lanes, East West Highway would be restriped to eliminate the existing two-way left-turn lane and the existing parking lanes along the north and south curb lanes. The existing signal phasing at the signalized intersections at Mustang Drive and 64th Place would not be modified; however, the left-turn movements from East West Highway would be made from the new median transit lanes, which would be shared for a short distance upstream of these intersections. Low and Medium Investment LRT would continue east along East West Highway in dedicated transit lanes until reaching the diamond interchange at the Baltimore-Washington Parkway. At the existing signalized intersections of the northbound and southbound MD 295 off-ramps, a new signal phase would be added to allow Low and Medium Investment LRT to leave the dedicated median transit lanes and enter the existing travel lanes beneath the Baltimore-Washington Parkway overpasses. After clearing the overpasses, Low and Medium Investment LRT would then re-enter two new dedicated median transit lanes. These alternatives would then use the existing signal phasing at the intersection of East West Highway and Veterans Parkway and Riverdale Road to turn into two new dedicated transit lanes within the median on Veterans Parkway. These alternatives would continue along the same alignment until reaching the signalized intersection at Annapolis Road.

At that intersection, Low Investment LRT would use a new signal phase to turn left from Veterans Parkway into a new exclusive transit right-of-way on the south side of Annapolis Road. Gate arms would be required at several business driveways along Annapolis Road, as well as at 77th Avenue and Garrison Road. The exclusive transit right-of-way would turn right and parallel to the southwest side of Harkins Road, crossing the IRS entrance across from West Lanham Drive using the existing traffic signal. New gate arms would be required at two business driveways along the west side of Harkins Road; however, volumes along Harkins Road are low, so these gate arms are not expected to cause operational problems. Low Investment LRT would terminate at the New Carrollton Metro Station.

At the intersection of Veterans Parkway and Annapolis Road, Medium Investment LRT would use the existing traffic signal phasing to cross Annapolis Road and continue in dedicated median transit lanes south along Veterans Parkway. At Ellin Road, a new signal phase would be added to allow Medium Investment LRT to turn left from the median of Veterans Parkway into a new exclusive transit right-of-way on the south side of Ellin Road. A new gate arm would be required at Hanson Oaks Court to separate automobile and transit movements at this unsignalized crossing. This alternative would then terminate at the New Carrollton Metro Station.

3.2.3. Impacts to Intersection Operations

A detailed analysis of the projected traffic operations at existing signalized intersections along the corridor was conducted for each of the No Build, TSM, and Build alternatives. Intersection capacities and levels of service (LOS) were determined based on the methodology presented in the 2000 version of the *Highway Capacity Manual*, published by the Transportation Research Board.

It should be noted that the Purple Line passes through an area that is already heavily congested during peak periods. LOS E and F operations are already occurring at a number of key intersections along the corridor. Typically, these intersections are expected to continue to operate at unacceptable levels of service (LOS F) in 2030 under the No Build and Build alternatives.

Level of Service

The level of service for a signalized intersection is based on the average delay per vehicle. LOS A represents the highest quality operations with very low delay (less than 10 seconds per vehicle). LOS F represents the lowest quality operations, with delay exceeding 80 seconds per vehicle. LOS F conditions are often the result of over-saturated conditions, where vehicle demand at the intersection exceeds its capacity to process vehicles. Under LOS F conditions, it is common for some vehicles to not pass through the intersection within a single cycle.

One of the key goals in designing the alternatives for the Purple Line was the minimization of impacts to automobile traffic at existing signalized intersections along the corridor, as well as to minimize the number of new grade crossings that would require gate arms and other measures, which would negatively impact traffic flow on major roadways.

Regarding the proposed stations, no detailed analysis was conducted to assess their impact on automobile traffic since no new park-and-ride facilities would be constructed as part of this project, almost all of the ridership would be walk access or transfers from other transit services. As has been noted previously, the station locations were selected to maximize walk access and transfers from the existing transit network; therefore, the stations would not be expected to promote measurable increases in vehicular traffic near the stations.

Changes to Traffic Volumes and Intersection Level of Service

Tables 3-17 and 3-18 summarize the intersection levels of service for the 64 signalized intersections within the corridor in the AM and PM peak hours under existing conditions, as well as for the projected 2030 No Build, TSM, and Build alternatives.

No Build Alternative

The substantial increase in volumes projected under the No Build alternative would result in increased congestion throughout the corridor; this trend is most obvious at the intersections currently operating at or near capacity and are projected to experience a substantial increase in queuing and delay in 2030.

TSM Alternative

Under the TSM alternative, which would provide intersection improvements to increase travel time reliability and slightly reduce transit travel times, no intersections are expected to experience a decrease in the overall intersection level of service. Isolated minor street approaches may experience minor increases in delay due to the provision of signal priority; however, this increase in delay would be balanced by decreases in delay for the major street movements.

Build Alternatives

The Build alternatives are generally expected to maintain traffic conditions. The addition of left turn lanes is expected to improve traffic congestion in some locations, while the use of shared lanes by the Purple Line would degrade conditions in other locations. Minor intersection modifications would likely be needed at a number of locations throughout the corridor.

Table 3-17: AM Peak Hour Intersection Levels of Service

Intersection	Existing	2030 No Build	2030 TSM	2030 BRT			2030 LRT		
				Low	Med	High	Low	Med	High
Bethesda to Silver Spring									
Woodmont Avenue at Old Georgetown Rd	B	B	B	C	B	B	B	B	B
Woodmont Avenue at Edgemoor Lane	A	A	A	A	A	A	A	A	A
Old Georgetown Road at Edgemoor Lane	A	B	B	B	B	B	B	B	B
Woodmont Avenue at Norfolk Avenue	A	A	A	A	A	A	A	A	A
Woodmont Avenue at St. Elmo Avenue	A	A	A	A	A	A	A	A	A
Woodmont Avenue at Cordell Avenue	A	A	A	A	A	A	A	A	A
Woodmont Avenue at Battery Lane	B	B	B	B	B	B	B	B	B
Jones Bridge Rd at Wisconsin Avenue	D	E	E	F	E	E	E	E	E
Jones Bridge Rd at Glenbrook Pkwy	A	A	A	A	A	A	A	A	A
Jones Bridge Rd at Grier Rd	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Jones Bridge Rd at Platt Ridge Rd	A	A	A	A	A	A	A	A	A
Jones Bridge Rd at Connecticut Ave	F	F	F	F	F	F	F	F	F
Jones Bridge Rd at Manor Rd	A	A	A	A	A	A	A	A	A
Jones Bridge Rd at Jones Mill Rd	E	F	F	F	F	F	F	F	F
Connecticut Ave at Chevy Chase Lake Dr	A	A	A	A	A	A	B	A	A
16th Street at New Purple Line Crossing	N/A	N/A	N/A	A	A	N/A	A	N/A	N/A
Silver Spring to College Park									
2nd Ave at Spring St	B	B	B	B	B	B	B	B	B
2nd Ave at Fenwick Ave	A	A	A	A	A	A	A	A	A
2nd Ave at Cameron Ave	A	A	A	A	A	A	A	A	A
Colesville Rd at 2nd Ave	D	C	C	C	C	C	C	C	C
Wayne Ave at Ramsey Rd	C	C	C	C	C	C	C	C	C
Wayne Ave at Dixon Ave	Unsig.	A	A	A	B	A	B	B	A
Wayne Ave at Georgia Ave	C	D	D	D	D	D	D	D	D
Georgia Ave at Bonifant St	A	A	A	A	A	A	A	A	A
Georgia Ave at Thayer Ave	A	A	A	A	B	A	B	B	A
Wayne Ave at Fenton St	C	C	C	D	C	C	C	C	C
Wayne Ave at Cedar St	B	C	C	C	A	C	B	B	C
Wayne Ave at Dale Dr	B	C	C	D	B	F	B	B	F
Wayne Ave at Mansfield Rd	A	A	A	A	A	D	A	A	D
Wayne Ave at Sligo Creek Pkwy	D	E	E	E	C	F	C	C	F
Wayne Ave at Flower Ave	B	B	B	C	B	B	B	B	B
Piney Branch Road at Arliss St	A	A	A	A	A	A	A	A	A
Piney Branch Rd at Barron St	B	B	B	B	B	B	B	B	B
University Blvd at Piney Branch Rd	E	F	F	F	F	F	F	F	F
University Blvd at Carroll Ave	E	E	E	E	E	E	E	E	E
University Blvd at Shopping Center West	A	B	B	B	A	A	B	B	B
University Blvd at New Hampshire Avenue	E	F	F	F	F	F	F	F	F
University Blvd at Shopping Center East	A	B	B	B	B	B	B	B	B
University Blvd at 15th Avenue	B	B	B	B	B	B	B	B	B
University Blvd at Riggs Rd*	E	D	D	D	D	D	D	D	D
University Blvd at 23rd Avenue	A	A	A	A	A	A	B	B	B
University Blvd at W. Park Drive	A	A	A	B	A	A	B	B	B
University Blvd at Campus Drive	B	C	C	C	C	C	C	C	C
Adelphi Rd at Campus Drive	E	E	E	F	E	E	E	E	E
Campus Dr at Regents Drive	D	D	D	C	C	C	C	C	C
US 1 at Campus Drive	D	E	E	F	F	F	F	F	F
US 1 at Rossborough Lane**	A	B	B	B	B	B	B	B	B
Paint Branch Pkwy at Fire Academy	B	D	D	D	D	D	D	D	D
Paint Branch Pkwy at Metro Parking	B	B	B	B	B	B	B	B	B
Paint Branch Pkwy at River Road	B	B	B	B	B	B	B	B	B
College Park to New Carrollton									
Kenilworth Ave at River Rd	B	C	C	C	C	C	C	C	C
Kenilworth Ave at Rittenhouse St	A	A	A	A	A	A	A	A	A
Kenilworth Ave at East West Hwy	E	F	F	F	F	F	F	F	F
East West Hwy at 62nd Place	A	A	A	A	B	B	B	B	B
East West Hwy at 64th Ave	A	A	A	A	A	A	A	A	A
East West Hwy at Baltimore-Washington Pkwy Southbound Ramps	B	B	B	B	C	C	C	C	C
East West Hwy at Baltimore-Washington Pkwy Northbound Ramps	B	B	B	B	C	C	C	C	C
East West Hwy at 67th Ave	A	A	A	A	A	A	A	A	A
East West Hwy at Riverdale Rd	C	D	D	E	D	D	D	D	D
Annapolis Rd at Veterans Pkwy	F	F	F	F	F	F	F	F	F
Annapolis Rd at Harkins Rd	A	A	A	B	A	A	A	A	A
Harkins Rd at W. Lanham Rd	A	A	A	B	A	A	B	A	A
Veterans Pkwy at Ellin Rd	B	B	B	B	D	D	B	D	D

Cells shaded in blue indicate an adverse traffic effect (Levels reduced to D, E, or F) compared to No Build
Cells shaded in yellow indicate a beneficial effect (improved conditions) compared to No Build
* In 2030, Riggs Road includes a second westbound left-turn lane and a third eastbound through lane.
** In 2030, a new access point would be added to Baltimore Avenue to serve vehicle movements from the East Campus Development. Certain Purple Line alternatives would form the fourth leg at this new intersection.
N/A – Not applicable

Table 3-18: PM Peak Hour Intersection Levels of Service

Intersection	Existing	2030 No Build	2030 TSM	2030 BRT			2030 LRT		
				Low	Med	High	Low	Med	High
Bethesda to Silver Spring									
Woodmont Ave at Old Georgetown Rd	B	B	B	B	B	B	B	B	B
Woodmont Ave at Edgemoor Ln	A	A	A	A	A	A	A	A	A
Old Georgetown Rd at Edgemoor Ln	A	A	A	A	A	A	A	A	A
Woodmont Ave at Norfolk Ave	A	A	A	A	A	A	A	A	A
Woodmont Ave at St. Elmo Ave	B	B	B	B	B	B	B	B	B
Woodmont Ave at Cordell Ave	A	A	A	A	A	A	A	A	A
Woodmont Ave at Battery Ln	B	B	B	B	B	B	B	B	B
Jones Bridge Rd at Wisconsin Ave	E	F	F	F	F	F	F	F	F
Jones Bridge Rd at Glenbrook Pkwy	B	B	B	B	B	B	B	B	B
Jones Bridge Rd at Grier Rd	A	B	B	B	B	B	B	B	B
Jones Bridge Rd at Platt Ridge Rd	A	A	A	A	A	A	A	A	A
Jones Bridge Rd at Connecticut Ave	F	F	F	F	F	F	F	F	F
Jones Bridge Rd at Manor Rd	B	B	B	B	B	B	B	B	B
Jones Bridge Rd at Jones Mill Rd	F	E	E	F	E	E	E	E	E
Connecticut Ave at Chevy Chase Lake Dr	A	B	B	B	B	B	C	B	B
16th St at New Purple Line Crossing	N/A	N/A	N/A	A	A	N/A	A	N/A	N/A
Silver Spring to College Park									
2nd Avenue at Spring Street	C	C	C	C	C	C	C	C	C
2nd Avenue at Fenwick Avenue	A	A	A	A	A	A	A	A	A
2nd Avenue at Cameron Avenue	A	A	A	A	A	A	A	A	A
Colesville Road at 2nd Avenue	D	C	C	C	C	C	C	C	C
Wayne Avenue at Ramsey Road	C	C	C	C	C	C	C	C	C
Wayne Avenue at Dixon Avenue	Unsig.	B	B	B	B	B	B	B	B
Wayne Avenue at Georgia Avenue	C	D	D	D	D	D	D	D	D
Georgia Avenue at Bonifant Street	A	A	A	A	A	A	A	A	A
Georgia Avenue at Thayer Avenue	B	B	B	B	B	B	B	B	B
Wayne Avenue at Fenton Street	C	C	C	C	D	C	D	D	C
Wayne Avenue at Cedar Street	C	D	D	D	C	C	D	D	C
Wayne Avenue at Dale Drive	C	E	E	F	D	F	D	D	F
Wayne Avenue at Mansfield Road	A	A	A	A	A	C	A	A	C
Wayne Avenue at Sligo Creek Pkwy	C	E	E	F	E	F	E	E	F
Wayne Avenue at Flower Avenue	B	C	C	C	C	C	C	C	C
Piney Branch Road at Arliss Street	B	B	B	B	C	C	C	C	C
Piney Branch Road at Barron Street	B	B	B	B	B	B	B	B	B
University Blvd at Piney Branch Rd	F	F	F	F	F	F	F	F	F
University Blvd at Carroll Avenue	C	C	C	C	C	C	C	C	C
University Blvd at Shopping Center West	B	A	A	A	A	A	B	B	B
University Blvd at New Hampshire Avenue	F	F	F	F	F	F	F	F	F
University Blvd at Shopping Center East	B	B	B	B	B	B	B	B	B
University Blvd at 15th Avenue	C	C	C	C	C	C	C	C	C
University Blvd at Riggs Road*	F	F	F	F	F	F	F	F	F
University Blvd at 23rd Avenue	B	B	B	B	B	C	C	C	C
University Blvd at W. Park Drive	B	B	B	B	B	B	B	B	B
University Blvd at Campus Drive	C	D	D	D	D	D	D	D	D
Adelphi Road at Campus Drive	F	F	F	F	F	F	F	F	F
Campus Drive at Regents Drive	F	F	F	E	E	E	E	E	E
US 1 at Campus Drive	D	F	F	E	E	E	E	E	E
US 1 at Rossborough Lane**	B	E	E	E	E	E	E	E	E
Paint Branch Pkwy at Fire Academy	B	B	B	B	B	B	B	B	B
Paint Branch Pkwy at Metro Parking	A	A	A	A	A	A	A	A	A
Paint Branch Pkwy at River Road	B	B	B	B	B	B	B	B	B
College Park to New Carrollton									
Kenilworth Avenue at River Road	B	B	B	C	B	B	B	B	B
Kenilworth Avenue at Rittenhouse Street	A	B	B	B	B	B	B	B	B
Kenilworth Avenue at East West Hwy	F	F	F	F	F	F	F	F	F
East West Hwy at 62nd Place	B	C	C	D	C	D	C	C	D
East West Hwy at 64th Avenue	A	A	A	A	A	A	A	A	A
East West Hwy at Baltimore-Washington Pkwy southbound Ramps	C	C	C	C	E	D	E	E	D
East West Hwy at Baltimore-Washington Pkwy northbound Ramps	B	B	B	B	D	B	D	D	B
East West Hwy at 67th Avenue	A	B	B	C	B	B	B	B	B
East West Hwy at Riverdale Road	D	F	F	F	F	F	F	F	F
Annapolis Road at Veterans Pkwy	E	F	F	F	F	F	F	F	F
Annapolis Road at Harkins Road	B	B	B	B	B	B	B	B	B
Harkins Road at W. Lanham Road	A	A	A	B	A	A	B	A	A
Veterans Pkwy at Ellin Road	C	B	B	B	C	C	B	C	C

Cells shaded in blue indicate an adverse traffic effect (Levels reduced to D, E, or F) compared to No Build
Cells shaded in yellow indicate a beneficial effect (improved conditions) compared to No Build
* In 2030, Riggs Road includes a second westbound left-turn lane and a third eastbound through lane.
** In 2030, a new access point would be added to Baltimore Avenue to serve vehicle movements from the East Campus Development. Certain Purple Line alternatives would form the fourth leg at this new intersection.
N/A – Not applicable

Mitigation of Adverse Traffic Effects

The six Build alternatives would result in adverse effects to traffic at up to four of the 64 key intersections during the peak hours of operation. The potential adverse effects of the Build alternatives could in many cases be mitigated by the addition or modification of turn lanes at intersections.

3.2.4. On-Street Parking Impacts

Impacts to parking on private property are discussed in Chapter 4. The TSM alternative would not require the removal of on-street parking. However, several of the Build alternatives would require peak-hour restrictions of on-street parking along certain roadway segments. Several of the Build alternatives would also require the complete removal of on-street parking along several segments.

Low Investment BRT

Low Investment BRT would require the restriction during the AM and PM peak periods of all on-street parking in both directions along Woodmont Avenue, between Old Georgetown Road and Wisconsin Avenue. There are currently peak-hour parking restrictions along this segment, but those restrictions would need to be expanded to accommodate Low Investment BRT.

A short section of on-street parking would also need to be restricted during peak travel periods along Jones Bridge Road near the intersection of Jones Mill Road. This segment would serve as a queue jump lane for eastbound buses.

On-street parking would also need to be restricted during peak travel periods on Wayne Avenue, between Cedar Street and Mansfield Road, to accommodate Low Investment BRT. There are currently peak-hour parking restrictions along this segment, but those restrictions would need to be expanded to accommodate Low Investment BRT.

Medium Investment BRT

On-street parking along the north curb line of Bonifant Street would need to be removed to accommodate Medium Investment BRT. Parking along the south curb could remain under Medium Investment BRT if Bonifant Street is converted to one-way usage.

On-street parking would need to be restricted during peak travel periods on Wayne Avenue, between Cedar Street and Mansfield Road to accommodate Medium Investment BRT. There are currently peak-hour parking restrictions along this segment, but those restrictions may need to be modified or expanded.

Additionally, on-street parking along both the north and south sides of East West Highway, between 61st Place and 64th Avenue would need to be removed to accommodate the two new dedicated transit curb lanes proposed for this segment.

High Investment BRT

On-street parking along Wayne Avenue between Cedar Street and Mansfield Road would need to be removed to accommodate High Investment BRT.

Additionally, on-street parking along both the north and south sides of East West Highway, between 61st Place and 64th Avenue would need to be, at a minimum, restricted during peak travel periods to accommodate the two new dedicated median transit lanes.

Low Investment LRT

On-street parking along the north curb line of Bonifant Street would need to be removed to accommodate Low Investment LRT. Parking along the south curb would also need to be removed to maintain Bonifant Street as a two-way street.

On-street parking would need to be restricted during peak travel periods on Wayne Avenue between Cedar Street and Mansfield Road to accommodate Low Investment LRT. There are currently peak-hour parking restrictions along this segment, but those restrictions would need to be expanded.

Additionally, on-street parking along both the north and south sides of East West Highway, between 61st Place and 64th Avenue would need to be, at a minimum, restricted during the peak travel periods to accommodate the two new dedicated median transit lanes.

Medium Investment LRT

On-street parking along the north curb line of Bonifant Street would need to be removed to accommodate Medium Investment LRT. Parking along the south curb could remain.

On-street parking would need to be restricted during peak travel periods on Wayne Avenue between Cedar Street and Mansfield Road to accommodate this alternative. There are currently peak-hour parking restrictions along this segment, but those restrictions would need to be expanded.

Additionally, on-street parking along both the north and south sides of East West Highway, between 61st Place and 64th Avenue would need to be, at a minimum, restricted during peak travel periods to accommodate the two new dedicated median transit lanes.

High Investment LRT

On-street parking along Wayne Avenue between Cedar Street and Mansfield Road would need to be removed to accommodate High Investment LRT.

Additionally, on-street parking along both the north and south sides of East West Highway between 61st Place and 64th Avenue would need to be, at a minimum, restricted during peak travel periods to accommodate the two new dedicated median transit lanes.

3.3. Pedestrian and Bicycle Access

Numerous pedestrian and bicycle facilities are located throughout the corridor. The Interim Georgetown Branch Trail along the Georgetown Branch right-of-way, which extends from Bethesda to Silver Spring, is a heavily used hiker-biker trail on an exclusive alignment from Bethesda to Lyttonsville. At Lyttonsville the trail turns and runs parallel to the CSX corridor on existing streets. All Build alternatives except Low Investment BRT would include construction of the Capital Crescent Trail extension east from its current terminus in Bethesda at Woodmont Avenue to the Silver Spring Transit Center. Low Investment BRT would include construction of the trail from Jones Mill Road to the Silver Spring Transit Center. The conceptual designs for this trail are described in Chapter 2.

The Build alternatives would accommodate plans for connection of the Capital Crescent Trail to the Metropolitan Branch Trail and the Green Trail at the Silver Spring Transit Center. The Metropolitan Branch Trail and the Green Trail are separate projects from the Purple Line and are not dependent on the Purple Line. The Green Trail, which will connect the Sligo Creek Trail with the Silver Spring Transit Center, will follow Wayne Avenue parallel to the Purple Line surface alternatives. The MTA has worked with the M-NCPPC to accommodate the trail, with minimal impacts to adjacent properties. County guidelines permit a combined sidewalk and trail eight feet wide outside of a central business district. The trail would be on the north side of Wayne Avenue, separated from the transitway and road by a five-foot landscaped buffer.

Capital Crescent Trail in the Georgetown Branch Right-of-Way

In accordance with SHA guidelines, bicycle lanes would be added to University Boulevard as part of its reconstruction under Medium and High Investment BRT and all three LRT Alternatives.

The corridor includes several areas with substantial existing pedestrian activity. Existing pedestrian volumes are in the moderate to high range in downtown Bethesda, downtown Silver Spring, Takoma Park/Langley Park, and the University of Maryland areas. Both BRT and LRT systems operate safely today in comparable environments.

Although the station locations are regarded as conceptual and will be more specifically located in the subsequent Preliminary Engineering phase, they have been placed at suitable locations with respect to walk and bus transfer access to the system, including existing and planned development, other transit services, especially the Metrorail stations, and the planned transit centers at Silver Spring and Takoma/Langley Park. Many of the projected users of the Purple Line would be existing transit users who already make up a portion of the pedestrian activity along the corridor. These existing transit users would simply be shifting from the existing bus service to the Purple Line and would not represent new pedestrians making use of the facilities in the station areas. Therefore, the net increase in pedestrians due to the Purple Line could be less than the total ridership projections would indicate. Some increased concentrations of pedestrian activity would be expected on the approaches to the proposed station locations. The magnitude of the changes in pedestrian volumes is a function of the specific station and projected levels of ridership at those locations. A qualitative analysis of pedestrian facilities along the alignment indicates that they are likely to be sufficient to accommodate an increase in pedestrian activity. There is a well-developed network of sidewalks and pedestrian pathways in the area, and pedestrian signals (including pedestrian-actuated signals) are already provided at the vast majority of signalized intersections crossed by the Purple Line. Additional measures to accommodate any potential increases in pedestrian volumes in and around the proposed station areas could include: the widening of existing crosswalks and sidewalks, the installation of pedestrian-actuated signals at those locations that lack them, the enhancement of roadside signing alerting motorists of areas of increased pedestrian activity. Additionally, it could be appropriate to install median fencing, landscaping, or other measures at the station locations to encourage pedestrians to use the marked crosswalks at the signalized intersections.

3.4. Deliveries

Generally, High Investment BRT and the three LRT Alternatives would operate in dedicated transit lanes constructed in the median, or in the case of mixed traffic operations, in the inside travel lane. In most areas, there would be at least two general purpose travel lanes in each direction; which is sufficient to provide access to properties adjacent to the roadway alignment.

In the few instances where the alternatives would limit general purpose traffic to a single travel lane, such as Wayne Avenue between Cedar Street and Sligo Creek Parkway under the High Investment alternatives, stopping would generally not be permitted. This configuration may make access to and from driveways more difficult, though vehicles could encroach on the trackway if necessary.

Low and Medium Investment BRT would generally operate in the curb lanes, in either mixed traffic or dedicated transit lanes. These curb lanes could be used by vehicles accessing adjacent properties.

3.5. Emergency Vehicles

Emergency vehicles can be affected by a transit project due to changes in traffic volumes or operations along the corridor. The Build alternatives are generally expected to maintain, or in some cases, slightly improve the projected traffic operations under the No Build condition. Minor signal modifications would be required at a number of locations throughout the corridor, but these modifications would not prevent the continuing use or implementation of emergency vehicle preemption at those signals. LRT tracks are constructed in roadways flush with the roadway surface so they can be crossed by other vehicles. Thus they would not impede or create a barrier for emergency vehicles.

The Build alternatives would result in the removal of a limited number of existing buses, which operate on routes that would duplicate service. Additionally, the Build alternatives would typically operate in dedicated transit lanes; the net effect would be to reduce the number of transit vehicles operating in the general purpose lanes. Overall, the Build alternatives are not projected to substantially affect emergency vehicles operating in the corridor.

For the Purple Line, there is one major medical facility located adjacent to the proposed alternatives. The National Naval Medical Center is located along Jones Bridge Road, adjacent to Low Investment BRT. However, the National Naval Medical Center is a United States Naval facility, intended for treatment of servicemen and women; this facility is not an emergency treatment center for area residents. Access to this facility would not be affected by the presence of BRT vehicles along Jones Bridge Road.

There is one fire station located adjacent to Annapolis Road and Low Investment BRT and LRT in the New Carrollton area. This fire station

currently utilizes a dedicated traffic signal to access Annapolis Road. Neither alternative is expected to substantially impact the operations of this station; the LRT would operate in a dedicated right-of-way, along the south side of Annapolis Road in this area. However, due to the length of the LRT vehicles (up to 180 feet), there would be increased potential that the exit from the fire station could be blocked by a stopped light rail vehicle. This scenario is unlikely due to the provision of a dedicated transit right-of-way, but could be caused by another vehicle encroaching on the tracks. The remaining Build alternatives do not use Annapolis Road and would not affect the access to this fire station.

There are fire stations on some of the roads crossed by the Purple Line, including Connecticut Avenue, Georgia Avenue, Riggs Road, and US 1; the Purple Line would not impede access from these stations as it would not be operating on the roads in front of the stations. Where the Purple Line is in dedicated lanes emergency vehicles would benefit by the opportunity to travel in these lanes.

3.6. Construction Impacts

The Build alternatives would be constructed in a manner that would minimize potential negative impacts to traffic, businesses, and communities. Potential traffic impacts of construction could include the narrowing of travel lanes, temporary lane closures (which would probably be limited to off-peak or nighttime periods when traffic volumes are low), speed reductions, or short-term detours. Some existing bus routes may experience minor delays or be re-routed for short durations; however, no major service disruptions are expected. Prior to construction, a traffic management plan would be developed in coordination with SHA and both counties to minimize potential traffic impacts.

Public outreach would be conducted to inform motorists about upcoming changes to traffic patterns or detours. Emergency services would be consulted during the development of the traffic management plan, and such providers would be kept up to date regarding any detours or potential delays due to construction.

Chapter 4
Environmental Resources, Impacts, and Mitigation

Chapter 4. Environmental Resources, Impacts, and Mitigation

The purpose of this chapter is to provide information about the environmental resources present in the Purple Line corridor and the potential environmental effects that could be expected to occur with the construction and operation of the TSM and Build Alternatives, as described in *Chapter 2, Alternatives Considered*. Detailed information on each topic area analysis is presented in technical reports and summarized here.

The purpose of the AA/DEIS is to inform the public, resource agencies and decision-makers about the environmental impacts, beneficial and adverse, of the alternatives and design options. This chapter presents the findings of the environmental analyses to support the decision-making process in selection of a Locally Preferred Alternative. Other decision-making factors include capital costs, operating costs, and potential ridership. These and other considerations are the focus of *Chapter 6, Evaluation of Alternatives* where end-to-end alternatives are evaluated for their overall potential to address the project's goals and objectives.

It should be noted that the Locally Preferred Alternative could include segments from several of the defined end-to-end alternatives. Should this be the case, the environmental impacts could be assessed by a review of the impacts of the end-to-end alternatives from which the segments were selected.

Environmental resources and analyses presented in this chapter include the following:

4.1. Land Use and Economic Activity

The analysis of potential impacts to socioeconomic resources was conducted for the area within a 200-foot boundary of the proposed alignments and a quarter-mile of the proposed station locations. More detailed information is presented in the *Socioeconomic Technical Report*.

4.1.1. Socioeconomic Characteristics

This section presents the socioeconomic characteristics of the corridor and the larger region. It includes data on population, employment, and households.

Race and Ethnicity

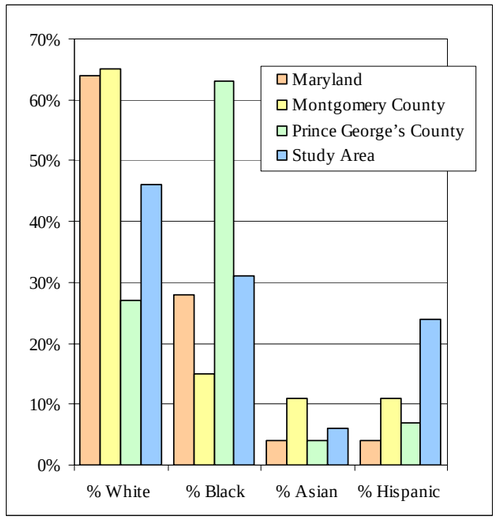
In 2000 the US Census began to record Hispanic ethnicity, as distinguished from race, and therefore the percentages given for Hispanic population include those who are White, Black, or other races.

The State of Maryland, and Montgomery and Prince George's Counties are experiencing substantial population growth. From the year 2000 to 2030 Maryland's population is projected to grow by 27 percent, while Montgomery and Prince George's Counties are projected to increase 31 and 23 percent, respectively. At the time of the US Census in 2000, there were approximately 141,000 people living in the corridor. The population in the corridor is expected to grow at the same rate as the rest of the region.

Racial and ethnic diversity of the state and counties and project area are depicted in Figure 4.1-1.

Household income data is provided by the Maryland Department of Planning State Data Center and is from 2004. Approximately nine percent of the state's population lives below the poverty level, as do seven percent of the Montgomery County population, nine percent of the Prince George's County population, and 12 percent of the population in the Purple Line corridor. The poverty level is defined by the Department of Health and Human Services. Median household income in Maryland is $66,600, while in Montgomery County it is $87,500, in Prince George's County it is $70,250, and the household income in the corridor is $48,800; see Figure 4.1-2.

Figure 4.1-1: Regional Racial and Ethnic Demographics

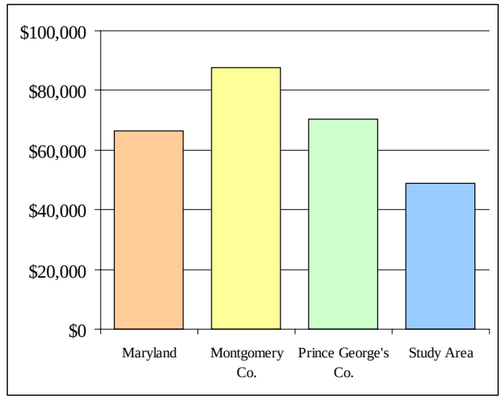


Within the corridor, more than 17 percent of the households do not have an available vehicle, as compared to eight percent and 11 percent in Montgomery and Prince George's Counties, respectively; see Figure 4.1-3.

Twenty-one percent of the corridor's working population uses public transportation to commute to work, substantially higher than transit use in either of the counties.

According to Census 2000 data, 90 percent of workers in Montgomery County and 86 percent of the workers in Prince George's County worked inside their respective counties. The average commute time for workers in both counties is just over one half hour.

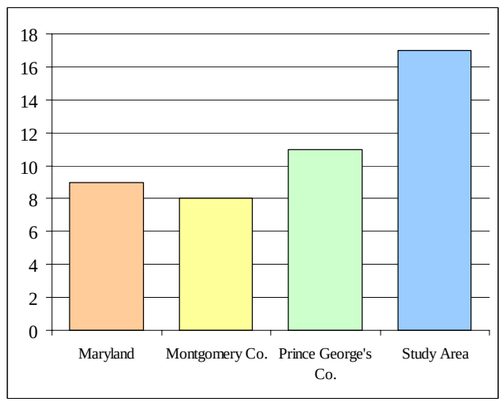
Figure 4.1-2: Median Household Income



Source: US Census 2000

According to Maryland Department of Labor 2006 data, 26 percent of the employed population in Prince George's County works in government-related industries as compared to 17 percent in Montgomery County.

Figure 4.1-3: Percentage of Households with No Vehicle Available



Source: US Census 2000

Regional employment and activity centers in Montgomery and Prince George's Counties include Bethesda, Silver Spring, Takoma Park/Langley Park, the University of Maryland, College Park, and New Carrollton. Each of these contains a mix of employment types, including commercial, institutional, and industrial jobs.

Within the corridor there are 11 major employers with more than 1,000 employees each: the National Institutes of Health, the National Naval Medical Center, Suburban Hospital, and Verizon located in Bethesda; the National Oceanic and Atmospheric Administration, Montgomery College, Discovery Communications, Holy Cross Hospital, and the U.S. Postal Service in Silver Spring; the University of Maryland in College Park; and the U.S. Internal Revenue Service in New Carrollton.

Additionally, a number of shopping areas are located in the corridor, including the International Corridor on University Boulevard, and Annapolis Road in New Carrollton. Smaller local retail and service establishments are interspersed throughout the corridor.

Montgomery County is expected to experience a 29 percent increase in employment and Prince George's County is expected to experience a 68 percent increase. The Bethesda Central Business District (CBD) is projected to experience an increase in jobs from 34,850 in 2005 to 41,550 in 2030. The Silver Spring CBD is projected to experience an increase in jobs from 29,750 in 2005 to 34,650 in 2030. New Carrollton is projected to experience an increase in jobs from 8,700 in 2005 to 15,350 in 2030, according to the MWCOG Round 7.0 Cooperative Forecasts.

Employment in the corridor is expected to increase by 32 percent from 2000 to 2030. Within the corridor, the highest level of growth is projected to be in the office sector (90 percent) in the eastern portion of the corridor. Other employment sectors within the corridor that will experience a high level of growth are industrial jobs (68 percent) followed by retail jobs (56 percent), both in the eastern portion of the corridor.

Federal Poverty Level

The U.S. Census Bureau establishes what is commonly referred to as the "federal poverty level". The Census Bureau uses a set of income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's calculated threshold, then that family and every individual in it is considered in poverty. In 1999 the thresholds ranged from $8,240 for a single person to $27,980 for a family of eight.

4.1.2. Land Use

Existing land uses within the corridor include residential, commercial, recreational, institutional, and industrial development. The corridor includes established inner-ring suburbs that contain pockets of high-density development such as Bethesda and Silver Spring. Future land use plans along the corridor include maintenance of communities with redevelopment and revitalization at some activity centers. Both Montgomery and Prince George's Counties plans and policies, consistent with Maryland Smart Growth goals, encourage and promote development around transit stations to maximize infrastructure investments, reduce reliance on the automobile, and reduce sprawl.

Compatibility with Local/Regional Plans

The Purple Line is generally compatible with all local and regional plans. Both Montgomery and Prince George's Counties are currently preparing functional master plans to support implementation of the Purple Line.

Planned and Approved Development

The MTA has coordinated with the counties and developers of a number of proposed developments in the corridor to insure that the Purple Line alternatives do not adversely impact the developments, and are compatible with, and wherever possible, support transit oriented development principles. These include:

- Woodmont East
- National Institutes of Health
- Pearl Street
- Chevy Chase Lake
- Falkland Chase
- Fenwick
- Maryland District Court
- Silver Spring Transit Center
- Silver Spring Fire Station Replacement
- 1050 Ripley Street
- Midtown Silver Spring (Ripley Street)
- 814 Thayer Street
- Fenton Village
- Studio Plaza (Thayer Avenue)
- New Silver Spring Library
- Long Branch/Arliss Street
- East Campus Redevelopment Initiative
- College Park Metro Station Joint Development
- M Square Research Park
- Kenilworth Revitalization
- New Carrollton Transit Oriented Development

4.1.3. Economy

The long term effects of the Purple Line on business conditions are anticipated to be positive. The support of local economic development is one of the Purple Line goals. The No Build Alternative is not anticipated to affect the economy. The TSM is anticipated to provide some improvements to service however it is not anticipated to substantially affect the economy. The Build Alternatives would benefit local business and employment conditions along the corridor by improving access to jobs and activity centers. Improved access provided by a fixed guideway transit service, where supported by appropriate zoning and land use policies, can be an incentive for both commercial and residential development. The extent of the growth around the Purple Line stations would be limited by the zoning in the station areas. Anticipated beneficial effects from the construction and operation of the project would "ripple" throughout the region. The Purple Line is anticipated to generate an expansion in payrolls and a proportional increase in consumer demands, as well as new employment in various industrial sectors and occupational categories. Short term benefits to the local economy during the construction of the project are anticipated to occur in the form of increased local production of materials, services, and labor.

Employment

Economic development would result in additional jobs in the corridor. Some jobs would be lost through the displacement of businesses, however, the displacement of businesses does not necessarily mean that the jobs would be eliminated since, where possible, businesses would be relocated within the corridor. The No Build and TSM alternatives are not anticipated to displace any businesses. Businesses anticipated to be displaced to accommodate the Purple Line Build Alternatives are primarily small businesses with less than 20 employees each, though some are slightly larger retail and service businesses with an estimated 25 to 75 employees located in Silver Spring, Chevy Chase, Lyttonsville, and Takoma Park.

The Purple Line would result in the relocation of workers at those businesses, although the number of jobs anticipated to be displaced would be small compared to overall employment in the corridor. Operation of the Purple Line is anticipated to create local jobs, particularly at the maintenance and storage facilities. The actual construction of the Purple Line would result in short-term employment in the corridor.

Local Plans in the Purple Line Corridor

- Comprehensive Amendment to the Bethesda/Chevy Chase Master Plan (1990)
- Comprehensive Amendment to the Bethesda Central Business District Sector Plan (1994)
- Woodmont Triangle Amendment to the Sector Plan for the Bethesda CBD (2006)
- North and West Silver Spring Master Plan (2000)
- Silver Spring Central Business District and Vicinity Sector Plan (2001)
- East Silver Spring Master Plan (2000)
- Strategic Framework for Transit-Oriented Development in Prince George's County (2003)
- Takoma Park Master Plan (2000)
- Approved Transit District Development Plan for the College Park-Riverdale Transit District Overlay Zone (1997)
- Planning for the University Boulevard Corridor (2003)
- Approved College Park US 1 Corridor Sector Plan and Sectional Map Amendment (2002)
- University of Maryland Campus Master Plan (2000)
- Annapolis Road Corridor Planning Study (2004)
- Approved Master Plan and Sectional Map Amendment for Planning Area 68 (1994)
- New Carrollton Transit-Oriented Development Strategy Planning Study (2004)
- Bladensburg-New Carrollton and Vicinity – Approved Master Plan and Sectional Map Amendment for Planning Area 69 (1994)

Business Property Displacements

The property acquisitions identified below (Table 4.1-1) are based on conceptual planning and engineering, and are intended to provide information on the general order of magnitude of property impacts, as well as allow a comparison of the impacts of the alternatives. The MTA has aspired to avoid direct property impacts and will continue to do so as the design is refined. Determinations regarding property acquisition will be made during the final design phase of the project following the issuance of a Record of Decision.

The displacements identified are business properties, and as such may contain more than one business; for example, the properties along the CSX corridor include two strip shopping centers.

Business properties that would be displaced would be acquired at fair market value with compensation provided for moving expenses. All property acquisition will be conducted in conformance with the Uniform Relocation and Real Property Acquisitions Policies Act of 1970 (42 USC 4601), as amended by Title IV of the Surface Transportation & Uniform Relocation Assistance Act of 1987 (P.L.100-17) and Public Law 105-117. State- funded projects in Maryland must comply with Sections 2-112 and Subtitle 2,

Table 4.1-1: Business Property Displacements

	Low Invest. BRT	Med. Invest. BRT	High Invest. BRT	Low Invest. LRT	Med. Invest. LRT	High Invest. LRT
Brookville Road	0	0	0	1-2	1-2	1-2
Lyttonsville Maintenance and Storage Facility	0	0	0	1-2	1-2	1-2
Georgetown Branch ROW near Stewart Avenue	0	0	0	2	2	2
CSX corridor	1	2	2	4	4	4
Bonifant Street	N/A	1	N/A	1	1	N/A
Silver Spring Avenue, west of Georgia Avenue	N/A	N/A	1-2	N/A	N/A	1-2
University Boulevard	0	3	3	3	3	3
Kenilworth Avenue	0	2	2	2	2	2
East West Highway in Riverdale Park	0	0	0	1	1	2
Annapolis Road	1	0	0	1	0	0
Total	**2**	**8**	**8-9**	**16-18**	**16-18**	**16-19**

Section 12-201 to 12-212 of the Real Property Article of the Annotated Code of Maryland.

Tax Base Effects

Properties acquired for the Purple Line Build Alternatives contribute a very small amount of taxes relative to the overall tax base; substantial impacts to fiscal conditions are not anticipated.

4.2. Communities

The No Build, TSM, and Build Alternatives would affect people, the built environment, the natural environment, and travel options (private vehicles, public transit, and biking or walking). The effects would vary between alternatives. For the purpose of analysis of community effects, the corridor was divided into 16 communities (see Figure 4.2-1). The TSM and Build Alternatives would improve mobility and access for all of the communities, including access to community facilities. A brief description of each community and its social and economic demographics is followed by a discussion of potential effects.

- **Residential Property Displacements and Acquisitions** – Residential displacements are the complete taking of property. Residential properties within the proposed right-of-way or substantially affected by the proposed right-of-way (i.e., inaccessible, close proximity to improvements) have been identified as displacements. Residential property acquisitions are partial or “strip takes” of property.
- **Access** – Access effects are assessed by determining where the alternatives would result in changes to the existing pattern of vehicular or pedestrian/bicycle traffic or the restriction of access at locations where access currently exists.
- **Mobility** – Mobility effects are assessed through the change in transportation options, as well as changes in the efficiency of travel. These impacts are indicated by the expansion, addition, reduction, or removal of travel lanes, transit, or pedestrian facilities.
- **Parking** – Parking effects are assessed by determining where the alternatives would result in permanent changes in public parking availability. These effects are indicated by changes to parking restrictions and the addition or loss of parking spaces.
- **Community Cohesion** – Community cohesion effects are assessed by determining potential disruption in the interaction among people and groups within a community, the use of community facilities, residential stability, and length of time residents have resided in the community. These impacts may occur because of a physical barrier, change in land use, displacements, or other effects of a project.
- **Visual Quality** – Community character and aesthetic effects are assessed by determining where the options would result in the addition of new elements or the removal of existing features from the visual environment and where the options would change the visual character of the community.
- **Community Facilities** – Community facility effects are assessed by determining if there are property impacts or changes in access or parking that would affect community facilities. Community facilities are typically structures or spaces that provide a variety of services, including park and recreation areas, educational facilities, health care facilities, religious facilities, emergency services, public utilities, transportation facilities, post offices, town halls, and community and recreation centers.
- **Noise** – Noise effects are assessed by determining where increases in noise generated by the alternatives and stations would exceed FTA noise abatement criteria. These criteria are discussed in more detail in Section 4.8.

Property Displacements

Often, one of the adverse social impacts associated with constructing a transit project is the need to displace homes and businesses. The comparison among alternatives of the number of displacements may be a key factor in the decision of which alternative or alignment is selected. Avoiding displacements, particularly residential displacements, has been a high priority in Purple Line planning. Where displacements are unavoidable they will be conducted following the guidance of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4601), also known as the "Uniform Act", establishes a policy for the fair and equitable treatment of persons displaced as a result of federal and federally assisted programs.

4.2.1. Bethesda

Bethesda is a mixed-use area with single and multi-family residences surrounding the dense urban center. Major facilities include the National Institutes of Health and the National Naval Medical Center.

With approximately 9,900 people, more than 80 percent of the population is White, five percent Black, nine percent Asian, and nine percent Hispanic.

Race and Ethnicity

In 2000 the US Census began to record Hispanic ethnicity, as distinguished from race, and therefore the percentages given for Hispanic population include those who are White, Black, or other races.

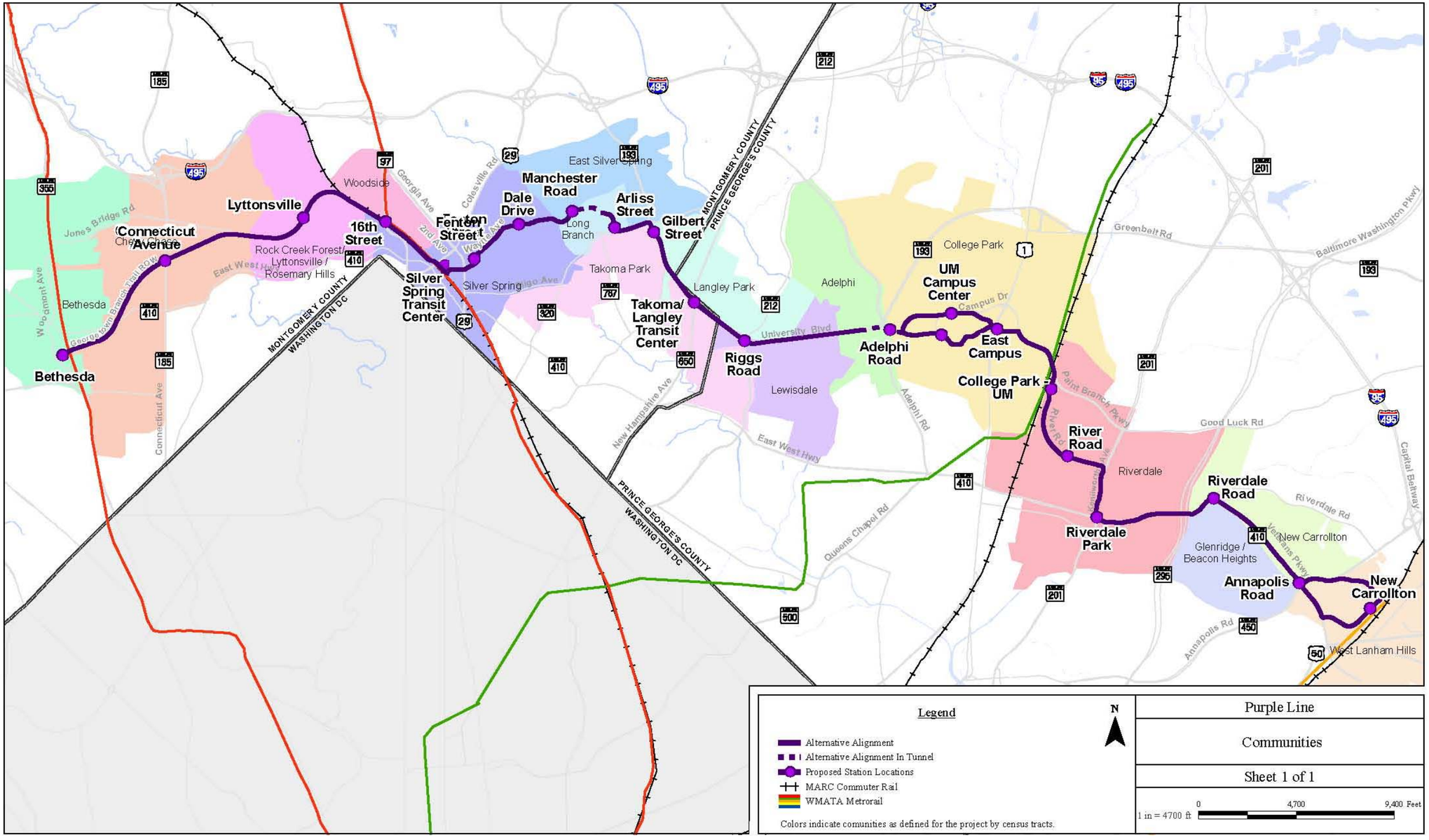
The median annual household income is $78,300. Seven percent of the population lives at or below the Federal poverty guidelines. Seven percent of the households are linguistically isolated.

Linguistically Isolated Households

Linguistically Isolated Households are those in which there is no person over the age of 14 who speaks English “very well” or speaks a non-English language and speaks English "very well.” In other words, all members of the household 14 years old and over have at least some difficulty with English.

This community has extensive transit service including Metrorail, WMATA Metrobus and Montgomery County Ride On. Metrorail Red Line stops include the Medical Center and Bethesda stations. A free trolley, the Bethesda Circulator, serves portions of the CBD. A segment of the heavily used Interim Georgetown Branch Trail is located in the community. Twenty-four percent of the community’s population uses public transportation to commute to work. Eighteen percent of Bethesda households have no vehicle available.

Figure 4.2-1: Communities



None of the alternatives would require residential property acquisition or displacements, or affect community cohesion in Bethesda. The Low Investment BRT would result in strip acquisitions from property owned by the National Institutes of Health and the National Naval Medical Center.

Access to and across the Interim Georgetown Branch Trail is now unrestricted; under the No Build and TSM Alternatives, this would not change. Under each of the Build Alternatives, access to the permanent Capital Crescent Trail and across the Georgetown Branch right-of-way would be directed to specific locations.

The Low Investment BRT Alternative would result in the expansion of the current peak hour parking restrictions on Woodmont Avenue.

The most substantial impact to the visual environment by the Build Alternatives would be the introduction of transit along the Georgetown Branch right-of-way and the loss of vegetation to accommodate the transitway.

Four locations in the Bethesda community were monitored for noise. No noise impacts are anticipated from any of the alternatives.

4.2.2. Chevy Chase

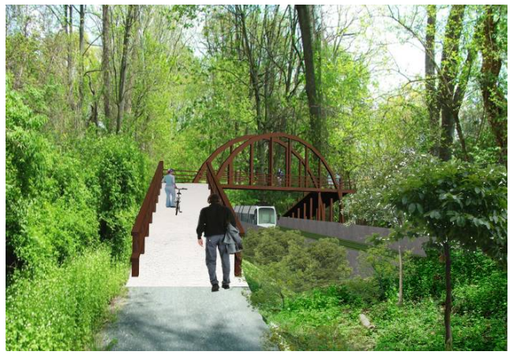
The Chevy Chase community is primarily residential in character. It was developed in the late 19th century as a streetcar suburb by the Chevy Chase Land Company. The majority of the housing in Chevy Chase is single-family detached houses, with some townhouses and multifamily buildings. The community includes some small specialty retail centers. Seventy-seven percent of the housing units in the community are owner-occupied. A section of the Interim Georgetown Branch Trail runs east to west through the community and is used in large numbers by walkers and bikers. The Columbia Country Club golf course was built on either side of the Georgetown Branch right-of-way. Founded in 1898, this 130-acre private club was opened at its current location in 1911.

With approximately 8,200 people, the population in Chevy Chase is 92 percent White, three percent Black, three percent Asian, and four percent Hispanic. The median annual household income is $131,150. Two percent of the population lives at or below the Federal poverty guidelines. Two percent of the households are linguistically isolated.

The community is served by Metrobus and Ride On. Fourteen percent of the community's population uses public transportation to commute to work. The percentage of households with no vehicle available is 11 percent.

Low Investment BRT could result in the displacement of one residential property at Jones Bridge and Jones Mill Roads, and temporary construction easements at nine residential properties on Jones Bridge Road. All other Build Alternatives use the Georgetown Branch right-of-way and do not require any residential property acquisitions in the Chevy Chase community.

Trail Crossing west of Jones Mill Road



Access to and across the Interim Georgetown Branch Trail is now unrestricted; under the No Build and TSM Alternatives this would not change. Under each of the Build Alternatives access to the permanent Capital Crescent Trail and across the Georgetown Branch right-of-way would be directed to specific locations.

Low Investment BRT would result in the removal of some on-street parking during peak hours on Jones Bridge Road, near Jones Mill Road.

The most substantial impact to the visual environment by the Build Alternatives would be the introduction of transit along the Georgetown Branch right-of-way and the loss of vegetation to accommodate the transitway. The aerial structure carrying the Purple Line over Connecticut Avenue as part of Medium and High Investment LRT and High Investment BRT, would introduce a new element into the visual environment, however a bridge structure is compatible with the existing visual environment of this major arterial.

Low Investment BRT would require a temporary construction easement from North Chevy Chase Elementary School. The Medium and High Investment BRT and all LRT Alternatives would require temporary construction easements in the Columbia Country Club to relocate a golf cart roadway.

Eleven locations in the Chevy Chase community were monitored for noise. No noise impacts are anticipated from any of the Build Alternatives.

4.2.3. Rock Creek Forest/Lyttonsville/ Rosemary Hills

The Rock Creek Forest/Lyttonsville/Rosemary Hills community is mostly residential (including a mix of high-rise, townhouses, garden apartment, and single family houses) with a small light industrial area located along Brookville Road.

With approximately 5,600 people, the community is 43 percent White, 31 percent Black, seven percent Asian, and 27 percent Hispanic. The median household income is $48,700. Nine percent of the population lives at or below the Federal poverty guidelines. Sixteen percent of the households are linguistically isolated.

This community is served by Metrobus and Ride On and the Interim Georgetown Branch Trail runs through the community. Twenty-three percent of the community's population uses public transportation to commute to work. Thirteen percent of the community's households have no vehicle available.

None of the BRT alternatives would require residential property acquisitions. The Build Alternatives would require a strip acquisition from the Roundhill Apartments on Freyman Drive. The LRT alternatives would require a temporary construction easement from five properties on Talbot Avenue. All Build Alternatives would require a strip acquisition from Rosemary Hills Elementary School for the construction of the Capital Crescent Trail, but this acquisition would not affect any of the facility's uses.

Access to and across the Interim Georgetown Branch Trail is now unrestricted; under the No Build and TSM Alternatives this would not change. Under each of the Build Alternatives access to the permanent Capital Crescent Trail and across the Georgetown Branch right-of-way would be directed to specific locations.

The most substantial impact to the visual environment by the Build Alternatives would be the introduction of transit along the Georgetown Branch right-of-way and the loss of vegetation to accommodate the transitway. The proposed maintenance and storage facility at Lyttonsville currently operates as a Montgomery County maintenance facility for Ride On buses and other

County maintenance functions. The site would be expanded to accommodate the Purple Line; however it would be a minor change in the existing viewshed. Introduction of the transitway between the CSX and the residential property and school along Porter Road would be a new visual element.

Three locations in the Rock Creek Forest/ Lyttonsville/Rosemary Hills community were monitored for noise. No noise impacts are anticipated from any of the Build Alternatives.

4.2.4. Woodside

The Woodside community is predominantly suburban and residential with extensive commercial uses along Georgia Avenue. Bordered by the Metropolitan Branch railroad right-of-way, currently used by freight, MARC commuter rail, Metrorail, and Amtrak, the community also contains major arterials carrying large volumes of traffic into and out of Washington, D.C. Forty-one percent of housing units in the community are owner-occupied. This community is on the outskirts of downtown Silver Spring.

With approximately 3,600 people, the community is 55 percent White, 33 percent Black, five percent Asian, and 25 percent Hispanic. The median annual household income is $72,400. Eight percent of the population lives at or below the Federal poverty guidelines. Five percent of the households are linguistically isolated.

The Woodside community is served by Metrobus and Ride On. Thirty-three percent of the community's population uses public transportation to commute to work. Fifteen percent of community's households report having no vehicle available.

The construction of the Capital Crescent Trail along the north side of the CSX right-of-way (part of all Build Alternatives) would require temporary construction easements from two residential properties, though no displacements are required.

Introduction of the trail is the only visual effect anticipated.

Two locations in the Woodside community were monitored for noise. Neither is anticipated to experience noise impacts.

4.2.5. Silver Spring

Silver Spring is an older commercial center and residential community that is experiencing dramatic revitalization, commenced in the last ten years. The downtown is largely high-rise buildings containing a mix of office, retail, and residential uses. Much of the redevelopment has been retail and entertainment oriented and Silver Spring now boasts a lively nightlife. The surrounding communities include both single and multi-family housing. Fourteen percent of the housing units are owner-occupied.

With approximately 15,500 people, Silver Spring is 39 percent White, 42 percent Black, seven percent Asian, and 14 percent Hispanic. The median annual household income is $46,000. Nine percent of the population lives at or below the Federal poverty guidelines. Seven percent of the households are linguistically isolated.

Currently there are two trails, the Interim Georgetown Branch Trail and the Sligo Creek Stream Valley Trail in Silver Spring, but two more trails, the Metropolitan Branch Trail and the Green Trail are planned for construction. The community is served by an extensive transit network including the Metrorail Red Line, the MARC Brunswick Line, and bus service provided by Metrobus, Ride On, and MTA's Commuter Bus service. Construction of the new Silver Spring Transit Center is underway, which will expand the current Metro Station to accommodate growing demand for public transportation and provide a centralized multi-level transit facility. The new facility will incorporate Metrobus, Ride On, Metrorail, MARC train, intercity bus, and local taxi service under one roof. It has also been designed to accommodate the Purple Line. The Transit Center should be completed by fall 2010. Thirty-four percent of the community's population uses public transportation to commute to work. The percentage of the community's households with no vehicle available is approximately 24 percent.

Each of the Build Alternatives requires strip acquisitions along the CSX right-of-way. Each Build Alternative would require property acquisition from one residence and displacement of two other residences on Leonard Drive. Each of the Build Alternatives except Low Investment BRT would result in displacements from one building of the Barrington Apartments and two buildings of the Falkland Apartments. Medium and High Investment BRT and LRT would require strip acquisitions at intersections on Wayne Avenue where widening is required for left turn lanes. These Alternatives would also require temporary construction easements from some residences on Wayne Avenue to regrade and reconstruct driveway connections. High Investment BRT would require temporary construction easements along Wayne Avenue. The Silver Spring/Thayer Avenue design option for the High Investment BRT and LRT Alternatives would require both property acquisition and temporary construction easements at some residences along Thayer Avenue, Hartford Avenue, and Dale Drive.

All Build Alternatives except for Low Investment BRT would require temporary construction easements from Silver Spring International Middle School. The Silver Spring/Thayer Avenue design option contains a portal behind the East Silver Spring Elementary School and would require property acquisition from the school.

Medium Investment BRT and Low and Medium Investment LRT would require the removal of on-street parking from the north side of Bonifant Street. Under Low and Medium Investment BRT and LRT parking on Wayne Avenue between Cedar Street and Mansfield Road would be restricted during peak hours similar to the current parking restrictions. Under High Investment BRT and LRT all on-street parking along Wayne Avenue between Cedar Street and Mansfield Road would be removed.

Introduction of the transitway between the CSX and the commercial and residential apartment along 16th Street would be a new visual element. The introduction of the LRT alternatives along Wayne Avenue and along Thayer Avenue (for the Silver Spring/Thayer Avenue design option) would result in a substantial visual effect. High Investment BRT and LRT include a tunnel and the associated tunnel portal on Wayne Avenue, introducing a new visual element to the community.

Eight locations in the Silver Spring community were monitored for noise. One location along the CSX right-of-way at Leonard Drive would experience moderate noise impacts under all of the BRT Alternatives. A monitoring location at 16th Street between East West Highway and Spring Street is anticipated to experience noise impacts under the Medium and High Investment BRT alternatives. Two locations along Wayne Avenue, one near Cedar Street and one near Mansfield Road, would experience moderate noise impacts under each of the BRT Alternatives. Another location along Wayne Avenue near Dale Drive would experience moderate noise impacts under Medium and High Investment BRT.

4.2.6. East Silver Spring

The East Silver Spring community is bounded by Sligo Creek to the west and Northwest Branch Stream Valley Park to the east. The community includes a mix of single family homes and garden apartments, with some commercial development along the major roadways. Approximately 54 percent of the housing in the community is owner-occupied.

With approximately 9,800 people, East Silver Spring is 36 percent White, 30 percent Black, nine percent Asian, and 25 percent Hispanic. The median annual household income is $56,550. Thirteen percent of the population lives at or below the Federal poverty guidelines. Sixteen percent of the households are linguistically isolated.

The community is served by Metrobus and Ride On. Thirty-four percent of the population uses public transportation to commute to work and 12 percent of the households have no vehicle available.

The community is crossed by the Sligo Creek Stream Valley Trail, the Long Branch Trail, and the Northwest Branch Stream Valley Trail.

Each of the Build Alternatives would result in strip acquisitions of residential property along Wayne Avenue and Piney Branch Road.

No impacts to parking or community cohesion are anticipated.

On Wayne Avenue the introduction of LRT would be a new visual element as would the tunnel portal just off of Wayne Avenue.

Two locations in the East Silver Spring community were monitored for noise. Neither is anticipated to experience noise impacts.

4.2.7. Long Branch

The Long Branch community is bounded by Sligo Creek to the west and Long Branch Creek to the east. This is a suburban community consisting of single-family houses, townhouses, garden-style apartment buildings, and a small commercial area of shops and restaurants at Flower Avenue and Piney Branch Road.

With approximately 3,800 people, 31 percent of the population is White, 31 percent Black, eight percent Asian, and 37 percent Hispanic. The median annual household income is $44,400. Eleven percent of the population lives at or below the Federal poverty guidelines. Nineteen percent of the households are linguistically isolated.

The Long Branch community is served by Metrobus and Ride On. Thirty percent of the community's population uses public transportation to commute to work, and 18 percent of the households have no vehicle available.

High Investment BRT and all LRT Alternatives would result in the displacement of one apartment building on Plymouth Street and one residence at the corner of Arliss Street and Flower Avenue; and six right-of-way acquisitions from residential property along Plymouth and Reading streets for the Plymouth Street tunnel. In addition, strip acquisitions would be required from 13 residential properties on Piney Branch Road under the Silver Spring/Thayer Avenue design option.

Parking along Arliss Street would be eliminated under each of the alternatives. However, the planned redevelopment of the commercial properties on Arliss Street could include the addition of on-street parking if desired.

The two tunnel portals, one off of Wayne Avenue, and one on Arliss Street would introduce a new visual element in this community.

Two locations in the Long Branch community were monitored for noise. One location along Arliss Street is anticipated to experience moderate impacts under the Medium and High Investment BRT alternatives.

4.2.8. Takoma Park

The Takoma Park community as defined for this study is located primarily in Montgomery County but includes the Carole Highlands and Hillwood Manor communities in Prince George's County. The community is predominately residential. Commercial areas are located along the major roadways of University Boulevard, New Hampshire Avenue, Piney Branch Road, and Carroll Avenue. Approximately 40 percent of housing in the community is owner-occupied.

With approximately 12,600 people, the population of Takoma Park is 40 percent White, 26 percent Black, five percent Asian, and 35 percent Hispanic. The median annual household income is $46,300. Twelve percent of the population lives at or below the Federal poverty guidelines. Fifteen percent of the households are linguistically isolated.

The community is served by Metrobus and Ride On. Twenty-five percent of the community's population uses public transportation to commute to work, and 16 percent of the households have no vehicle available.

No property displacements are anticipated; however some strip property acquisition and temporary construction easements would be required under each of the Build Alternatives.

Parking impacts are anticipated along University Boulevard where the service road, now used for parking, would be removed.

Five locations in the Takoma Park community were monitored for noise. None are anticipated to experience noise impacts

4.2.9. Langley Park

The Langley Park community is located primarily in Prince George's County but also includes a small portion in Montgomery County. University Boulevard, commonly referred to as the "International Corridor" in the Langley Park area, contains restaurants, shops, and services that cater to a large immigrant population. The major immigrant groups are Latino, South Asian, and Vietnamese. Housing in Langley Park consists of a mix of housing types with many garden-style apartments near University Boulevard or New Hampshire Avenue. Twenty-one percent of the housing is owner-occupied.

With approximately 17,800 people, the population of Langley Park is 40 percent White, 26 percent Black, five percent Asian, and 62 percent Hispanic. The median household income is $39,550. Eighteen percent of the population lives at or below the Federal poverty guidelines. Forty percent of the households are linguistically isolated.

The Langley Park community is served by Metrobus, Ride On, and TheBus. The MTA and Montgomery and Prince George's Counties are constructing a transit center at University Boulevard and New Hampshire Avenue, an area known as the Takoma/Langley Crossroads The Takoma/Langley Transit Center will provide a centralized transfer point for the many bus routes in the area. Although independent of the Purple Line, this Transit Center would be a stop on the Purple Line.

Approximately 21 percent of the population uses public transportation to commute to work. The percentage of households with no vehicle available is 28 percent. The community has very

high levels of pedestrian activity, particularly near the intersection of University Boulevard and New Hampshire Avenue, which is a transfer point for many bus routes. Correspondingly, the community has a high pedestrian accident rate, and recent safety improvements have been undertaken to improve sidewalks and crosswalks along University Boulevard. The Transit Center is intended to further improve pedestrian safety in the Crossroads area.

Each of the Build Alternatives except Low Investment BRT would require strip acquisitions from four apartment complexes along University Boulevard.

Parking impacts are anticipated along University Boulevard where the service road, now used for parking, would be removed.

The introduction of the aerial structure over New Hampshire Avenue and Riggs Road, only provided for the High Investment Alternatives, would be a new visual element in the community.

Two locations in the Langley Park community were monitored for noise, two additional locations, one reported under the Takoma Park community and one reported under the Lewisdale community are adjacent to Langley Park. None of these four locations are anticipated to experience noise impacts.

4.2.10. Lewisdale

The Lewisdale community, bordered by the Northwest Branch Stream Valley Park, is almost entirely residential with the exception of one shopping center on University Boulevard. Housing consists of single-family and duplex residences. Sixty-one percent of the housing is owner-occupied.

With approximately 8,000 people, the community is 19 percent White, 48 percent Black, six percent Asian, and 33 percent Hispanic. The median annual household income is $52,300. Seven percent of the population lives at or below the Federal poverty guidelines. Fifteen percent of the households are linguistically isolated.

This community is served by Metrobus and TheBus. Twenty percent of the community's population uses public transportation to commute to work and 13 percent of the community's households report no vehicle available.

Each of the Build Alternatives would require strip acquisitions of residential property along University Boulevard.

Two locations in the Lewisdale community were monitored for noise. Neither is anticipated to experience noise impacts.

4.2.11. Adelphi

The Adelphi community is primarily residential with approximately 3,400 people; the population of Adelphi is 46 percent White, 24 percent Black, 14 percent Asian, and 20 percent Hispanic. The median annual household income is $49,550. Thirteen percent of the population lives at or below the Federal poverty guidelines. Seventeen percent of the households are linguistically isolated.

The Adelphi community is served by Metrobus, TheBus, and the University of Maryland Shuttle system. The Northwest Branch Trail, a pedestrian and bicycle route, connects the community to Montgomery County and the University of Maryland. Fifteen percent of Adelphi's population uses public transportation to commute to work and nine percent of the households report having no vehicle available.

Each Build Alternative would require temporary construction easements from residences on the north side of University Boulevard. The BRT alternatives would also require a temporary construction easement from the Graduate Hills / Graduate Gardens Apartments on the south side of University Boulevard.

Two locations in the Adelphi community were monitored for noise. Neither is anticipated to experience noise impacts.

4.2.12. College Park

The College Park community includes the City of College Park and the University of Maryland. The campus is the dominant feature of College Park, with approximately 36,000 students and 12,000 employees. The US 1 corridor is the main commercial area serving the community. Residential areas include graduate housing, generally garden apartments, and single family homes in the City of College Park. Thirty-eight percent of housing units in College Park are owner-occupied.

With approximately 15,500 people, the population of the College Park community is 71 percent White, 15 percent Black, nine percent Asian, and four percent Hispanic. The median annual household income is $53,750. Thirty-two percent of the community population lives below the poverty level. Four percent of the households are linguistically isolated.

The community is served by Metrorail, MARC, Metrobus, TheBus, and the University of Maryland Shuttle system. Nine percent of population uses public transportation to commute to work and 17 percent of the College Park households have no vehicle available.

The BRT Alternatives and Medium Investment LRT would require a temporary construction easement from University Baptist Church. The Preinkert/Chapel Drive design option would require a strip acquisition from one residential parcel on Campus Drive at Mowatt Lane. The Preinkert/Chapel Drive design option would result in the displacement of Preinkert Field House, which has already been slated for replacement by the University.

The Preinkert/Chapel Drive design option would introduce a new visual element to the University of Maryland campus as it is in an area that is on right-of-way that is currently primarily pedestrian or carrying low volumes of traffic. In addition, High Investment BRT and LRT alternatives would introduce tunnel portals at two locations, near UMUC and on the eastern side of the campus near the Mitchell Building.

Six locations in the College Park area were monitored for noise. None are anticipated to experience noise impacts.

4.2.13. Riverdale

The Riverdale community includes portions of the Town of Riverdale Park and other unincorporated communities such as Riverdale Heights. Residential development characterizes most of the area along with some offices for federal agencies and the University of Maryland Research Park. There is some older auto-oriented commercial development on Kenilworth Avenue and East West Highway. Forty-seven percent of the housing is owner-occupied.

With approximately 13,800 people, the population is 21 percent White, 45 percent Black, four percent Asian, and 28 percent Hispanic. The median annual household income is $52,850. Thirteen percent of the population lives at or below the Federal poverty guidelines. Fourteen percent of the households are linguistically isolated.

The Riverdale community is served by MARC, Metrobus, and TheBus. Sixteen percent of the community's population uses public transportation to commute to work and nine percent of the households report having no vehicle available.

All Build Alternatives except for Low Investment BRT would result in temporary construction easements from some residences on the north side of East West Highway/Riverdale Road and strip acquisitions at residential areas on the south side of the road. Low and Medium Investment BRT and LRT would result in strip acquisitions at some residences on the east side of Kenilworth Avenue. High Investment LRT would result in one to two displacements on the south side of East West Highway/Riverdale Road in the vicinity of Mustang Drive.

Medium and High Investment BRT would result in temporary construction easements at Refreshing Spring Church of God in Christ and at the St. Bernard School. Minor strip acquisitions may be necessary at the St. Bernard School.

For each of the Build Alternatives except Low Investment BRT on-street parking along both the north and south sides of East West Highway, between 61st Place and 64th Avenue would need to be, at a minimum, restricted during peak hours.

High Investment BRT and LRT would introduce a new visual element to the community: two tunnel portals, one just off of River Road, and one on East West Highway west of Kenilworth Avenue.

Five locations in the Riverdale community were monitored for noise. None are anticipated to experience noise impacts.

4.2.14. Glenridge/Beacon Heights

The Glenridge/Beacon Heights community is predominately residential with a mix of single family homes and garden apartments. Sixty-four percent of the housing units are owner-occupied.

With approximately 5,300 people, the population is 18 percent White, 70 percent Black, three percent Asian, and four percent Hispanic. The median annual household income is $50,550. Three percent of the households are linguistically isolated.

The Glenridge/Beacon Heights community is served by Metrobus and TheBus. Seventeen percent of the community's population uses public transportation to commute to work and 14 percent of the community households report having no vehicle available.

Each of the Build Alternatives (with the exception of Low Investment BRT) would require either temporary construction easements or strip property acquisitions at the East Pines Apartments and a single-family residence on 67th Place.

Two locations in this community were monitored for noise. Neither is anticipated to experience noise impacts from Purple Line operations. The Glenridge maintenance and storage facility would results in severe noise impacts from LRT.

4.2.15. New Carrollton

The New Carrollton community is primarily residential with two shopping centers located along Riverdale Road. Forty-four percent of the housing is owner-occupied.

With approximately 4,400 people, the population is 19 percent White, 67 percent Black, six percent Asian, and nine percent Hispanic. The median annual household income is $52,300. Ten percent of the population lives at or below the Federal poverty guidelines. Six percent of the households are linguistically isolated.

The community is served by Metrobus and TheBus. Fifteen percent of the community's population uses public transportation to commute to work and 18 percent of the households report having no vehicle available.

Two locations in the New Carrollton community were monitored for noise. Neither is anticipated to experience noise impacts.

4.2.16. West Lanham Hills

The West Lanham Hills community surrounds the New Carrollton Metro Station, includes the CSX rail corridor and rail yards used by CSX, Amtrak, MARC, and Metrorail. In addition to the transportation facilities the community includes some residential properties and industrial and office parks. Fifty-six percent of the housing is owner-occupied.

With approximately 2,300 people, the population is 22 percent White, 73 percent Black, and six percent Hispanic. The median annual household income is $ 45,900. Thirteen percent of the population lives at or below the Federal poverty guidelines. Five percent of the households are linguistically isolated.

The community is served by Metrorail, Amtrak, and MARC trains at the New Carrollton Metro Station, as well as Metrobus, TheBus, and Greyhound. Eighteen percent of the community's population uses public transportation to commute to work and nine percent of the households have no vehicle available.

Each of the alternatives would result in a strip acquisition from one residential property along 76th Avenue and would require right-of-way acquisition from nine residences on 78th Avenue.

Two locations in the West Lanham Hills community were monitored for noise. Neither is anticipated to experience noise impacts.

4.3. Environmental Justice

As defined by the Environmental Protection Agency, "Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*, directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects that its programs, policies, and activities may have on minority and low-income populations. To that end, an analysis of potential environmental justice considerations for the Purple Line was conducted.

The fundamental principles of environmental justice are:

- Avoiding, minimizing, or mitigating disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations
- Ensuring full and fair participation by all potentially affected communities in the transportation decision-making process
- Preventing the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations (USDOT, 1997)

Terms related to the evaluation of environmental justice include the following:

- Low-Income – a household income at or below the Department of Health and Human Services poverty guidelines
- Minority – a person who is Black, Hispanic, Asian American, American Indian, or Alaskan Native
- Adverse Effects – the totality of significant adverse individual or

cumulative human health or environmental effects

- Disproportionately High and Adverse Effect – an adverse effect that is predominately borne by a minority or low-income population or an adverse effect that will be suffered by the minority or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority and non-low-income population

4.3.1. Methodology

The process for evaluating environmental justice concerns includes the following steps:

- Determine the criteria for minority and low-income populations within the study area
- Identify and characterize the environmental justice populations within the study area
- Analyze the location and severity of anticipated impacts associated with the alternatives of the project
- Determine disproportionate high and adverse impacts, full and fair access, and denial of benefits to environmental justice populations

Characteristics of potential environmental justice populations were identified within the study area using U.S. Census 2000 block groups. The study area contains 90 block groups. The total population in the corridor is 140,981 people, with 91,127 (64.6 percent) identifying themselves as minorities and 15,340 (11.6 percent) meeting the definition of low-income. The minority and low-income percentages for Montgomery County are 40.6 percent and 5.4 percent, respectively. The minority and low-income percentages for Prince George's County are 75.6 percent and 7.7 percent, respectively (Figure 4.3-1).

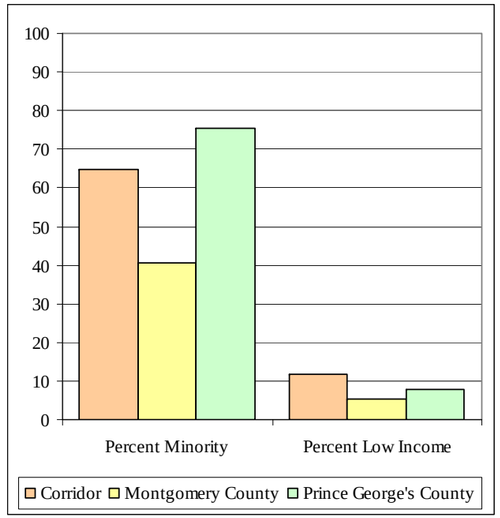
Consistent with Council on Environmental Quality (CEQ) guidance, block groups that exceeded 50 percent minority have been considered minority populations. Similarly, block groups that exceeded 50 percent would be considered low-income populations. To be more inclusive of low-income populations and in accordance with the CEQ guideline's concept of "meaningfully greater," block groups that exceeded 11.6 percent low-income, the study area average, are also considered low-income populations. The percentage of low-income persons for the study area as a whole (11.6) was used as the low-income environmental justice threshold. The study area low-income threshold of 11.6 percent is greater than 50 percent of the poverty level in either Montgomery County (5.4 percent) or Prince George's County (7.7 percent). This was determined to represent a meaningfully greater as defined in the CEQ guidance. It was determined that this percentage was representative of the entire study area as it falls between the percentages for the Montgomery County portion of the study area (9.3 percent) and the Prince George's County portion of the study area (14.6 percent). It is also greater than the percentages of either county as a whole (Montgomery County 5.4 percent and Prince George's County, 7.7 percent) and the state of Maryland (8.5 percent).

Of the 90 block groups within the corridor, 64 are considered environmental justice populations having met the criteria cited above for minority or low-income populations (see Figure 4.3-2).

4.3.2. Supplemental Data

U.S. Census 2000 data provided the basis for establishing the location of environmental justice populations in the corridor. To corroborate the findings of the Census, and to support public outreach activities, supplemental sources were consulted regarding low-income and minority populations within the corridor. The supplemental sources included:

Figure 4.3-1: Summary of Minority and Low Income Populations



County and Government Officials

Planners from M-NCPPC both in Montgomery and Prince George's Counties and elected officials from Prince George's County were asked about changes in the populations of the corridor and the location of possible environmental justice communities. Responses included:

- Diversity of the populations of Takoma Park, Langley Park, and East Silver Spring has increased.
- After English, Spanish is the predominant language in the corridor, although various Asian and African languages are present.

The information provided on locations of environmental justice populations was consistent with U.S. Census 2000 data.

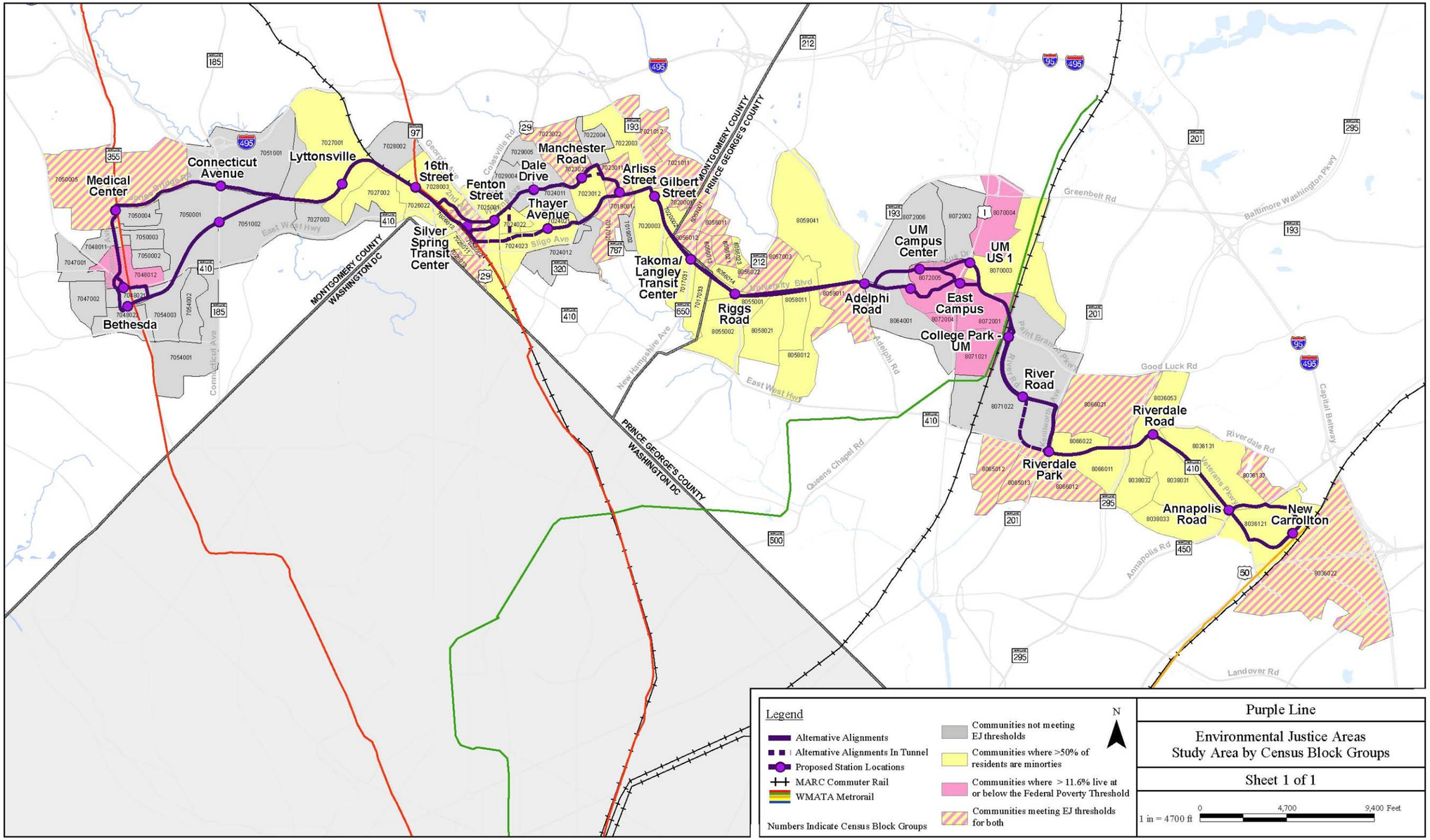
National Center for Educational Statistics (NCES)

NCES provides relatively recent demographic information for the public school student population for corridor schools. Its 2004-2005 Common Core of Data provides racial composition of the student populations, and the number of students eligible for free or reduced lunches for each public school. Elementary schools were identified as being most representative of their surrounding area because they have set boundaries and encompass the smallest possible geographic area. In general, the data from NCES was consistent with the U.S. Census 2000 data.

Government Assisted Housing Programs

In the corridor, the U.S. Department of Housing and Urban Development (HUD), the Maryland Department of Housing and Community Development (DHCD), the Housing Opportunities Commission (HOC) of Montgomery County, and the Prince George's County Housing Authority, provide housing assistance for low-income persons. Locations of public housing complexes and public and private complexes that accept Section 8 and other forms of rental assistance were provided by HUD, DHCD, and HOC. In general, the locations of subsidized housing complexes were in block groups that met the criteria for a low-income population. Scattered sites, usually single rental units, are located throughout the corridor.

Figure 4.3-2: Environmental Justice Areas



CASA de Maryland

CASA de Maryland (CASA) is a Latino and immigrant-based service and advocacy organization. CASA operates one day-laborer site in the corridor on University Boulevard near Gilbert Street and plans to open a second at the corner of University Boulevard and New Hampshire Avenue to serve the large number of local residents who are employed in this fashion industry. These locations are consistent with U.S. Census and information gathered from local planners.

Local Service Providers and Organizations

Local service providers and organizations often act as the voice of communities. They disseminate information and provide job, religious, and social networks. Within the Purple Line study area, this is especially true. Many service providers and organizations work with the area's growing immigrant population.

Information available through the service provider and organization websites and publications has been vital for understanding the many cultures of the project corridor. Representatives from many of the local service providers have been contacted and provided information that has been used by the MTA on population locations, potential meeting locations, community concerns, and input on project planning. See the *Public Outreach and Coordination Technical Report* for more information.

4.3.3. Effects on Minority and Low Income Populations

A map analysis was conducted to identify whether environmental effects would be disproportionately high and adverse for environmental justice populations. Based on the results of technical studies conducted for this project, the physical locations of potential adverse impacts were identified and these locations were analyzed to determine whether patterns or concentrations of adverse effects occurred in areas with environmental justice populations.

The adverse effects of the No Build Alternative, such as increasing congestion and travel time, would be similar for all communities, regardless of race or income. The No Build Alternative would not entail any changes to the physical environment, such as displacements or loss of resources. Therefore, high and disproportionately adverse effects to minority or low-income communities are not anticipated for the No Build Alternative.

The TSM alternative would improve transit service for all communities in the corridor, and like the No Build, would cause no displacements or loss of resources. Therefore the TSM would not have high or disproportionately adverse effects to minority or low-income populations.

The location and magnitude of effects associated with the Build Alternatives were examined to understand the potential for high and disproportionate adverse effects on environmental justice populations. The adverse effects of the Build Alternatives are not disproportionately located in environmental justice communities.

At this point in the project planning phase, it is not anticipated that any block group or groups containing environmental justice populations, would suffer disproportionately high and adverse impacts because of the operation of the Purple Line. Potential impacts to environmental justice populations, and the population of the study area as a whole, should continue to be investigated, and where appropriate, minimized or mitigated throughout the remainder of the planning and any future design and construction phases of the Purple Line project.

Environmental Justice Disproportional Effects Analysis

The adverse effects of the Build Alternatives are not disproportionately located in environmental justice communities.

Denial of Benefits

In an effort to assess the potential for the possible denial of benefits to environmental justice populations by the construction and operation of the proposed transit system, an analysis was completed to address location and access. It has been determined that the key benefits of the Purple Line are improved mobility and travel time to locations along the corridor and the provision of connectivity to other transit services and systems.

The Purple Line would provide accessibility to locations throughout the project corridor and to the Metrorail, MARC and Amtrak systems. The Purple Line station locations were selected based upon the density of residential development, activity centers, and creation of transfer points to other transit services. These locations are evenly distributed along the corridor and serve all populations, including environmental justice populations equally. Therefore, it is not anticipated that environmental justice populations will be denied the benefits of the proposed Purple Line.

Additionally, pedestrian enhancements to sidewalks, paths, and crosswalks would be constructed at various locations as part of the overall project. These enhancements would provide safer street crossings and improve access to several trails located within the corridor for pedestrians and bicyclists. Several of these proposed enhancements would be in areas that meet the environmental justice thresholds or that have environmental justice populations residing in those block groups. Therefore, it is not anticipated that environmental justice populations would be denied the benefits of the proposed Purple Line.

Full and Fair Access

Full and fair access to "meaningful" involvement by minority and low-income populations in project planning and development is an important aspect of environmental justice. Ensuring full and fair access means actively seeking the input and participation from those typically under-represented groups throughout all the project stages. Residents can provide important information on community concerns, special sites, and unusual traffic, pedestrian or employment patterns in the corridor. This information can be used in the design and evaluation of alternatives, to avoid negative impacts to valued sites, and to support the development of safe, practical, and attractive transportation options that are responsive to the concerns of environmental justice communities.

Participation of low income and minority populations in the Purple Line decision-making process has been advanced through:

- Expanded outreach to environmental justice communities to encourage attendance at, and participation in project meetings and open houses.
- Flyers delivered to homes in minority community for Community Focus Groups with low attendance.
- Direct mailing inviting residents in minority communities to Community Focus Groups where neighborhoods were not being represented.
- Invitations to Community Focus Groups sent to religious leaders of local houses of worship in Environmental Justice communities.

- Meetings with city and county agency staff, local elected officials, and community leaders to identify leaders of local communities; particularly those traditionally under-represented in the civic process. The groups identified included Action Langley Park, Impact Silver Spring, Puente Inc., and CASA de Maryland.
- Other community representatives identified and invited to participate in the Community Focus Group meetings were:
  - Prince George's County Latino Affairs Liaison
  - Montgomery County Department of Housing & Community Affairs
  - Montgomery County Business Development Specialist
- The translation of project newsletters and Open House announcement posters into Spanish; and distribution of newsletters, flyers, and posters to local Latino organizations and community centers.
- Providing translators at public project meetings. MTA's Outreach Manager for Washington Area Transit Programs is bilingual in Spanish and was active in outreach to the local Latino community.

The MTA developed a public outreach program called Community Focus Groups. These groups were composed of representatives of local community and civic associations.

The MTA expanded the outreach to include local religious leaders, local schools, and PTAs; worked with local community planners to identify and invite leaders of local minority-owned business groups, and advocacy groups. In some communities flyers were hand delivered to local residences informing them of the meetings. Particular advocacy groups the MTA has worked with include Action Langley Park, Impact Silver Spring, Puente Inc, and CASA.

Action Langley Park is a nonprofit organization that works to improve the quality of life for residents of Langley Park and its nearby neighborhoods, as well as immigrants in suburban Maryland. Action Langley Park sponsors Langley Park Day, an annual community fair. The MTA had a table at Langley Park Day in May 2008 to inform people about the Purple Line and solicit input on the project.

Impact Silver Spring is a not-for-profit organization that works to engage and empower community members with special emphasis on those communities that are traditionally under-represented in civic engagement: low income, minority, and immigrant communities. The MTA met with local community members to discuss the Purple Line and the potential benefits and impacts of the project.

Puente Inc. is a Prince George's County association of neighbors. Puente Inc.'s mission has been to provide health education and prevention services, carry out educational symposiums that foster inter-generational leadership, advocate on behalf of policy issues affecting the Latino community, and develop programs that foster and preserve positive Latino cultural values in Prince George's County.

4.4. Parks, Recreational Areas and Open Space

Montgomery County has 66,067 acres of parkland, recreation space, and open space. This total includes approximately 32,700 acres of M-NCPPC parkland, 12,000 acres of State parkland and 3,100 acres of National parkland. Two-thirds of the land in regional parks remains undeveloped in its natural state to help protect the environment. The M-NCPPC owns more than 395 developed parks that provide diverse active and passive recreational opportunities in the county.

Prince George's County contains over 50,400 acres of parkland including 25,240 acres of M-NCPPC owned parkland, 6,947 acres of river parks, 7,830 acres of stream valley parks, and 7,737 acres of developed parkland. Approximately one-third of the M-NCPPC owned parkland has been developed to provide active and passive recreational opportunities in the county. Undeveloped M-NCPPC parkland totals 2,726 acres.

The Department of Education (public schools) and private organizations also provide recreational areas and open space for citizens to enjoy.

4.4.1. Existing Parklands and Recreational Areas

Figure 4.4-1 identifies the public parklands and recreational areas located within 500 feet on either side of the Purple Line alignments.

The Columbia Country Club is a 139-acre private facility located at 7900 Connecticut Avenue that extends on both the north and south sides of the Interim Georgetown Branch right-of-way. The country club was determined eligible for the National Register of Historic Places in 2002.

The Rock Creek Pool and Tennis Club is a private facility located at 8619 Grubb Road in Silver Spring.

4.4.2. Potential Impacts and Benefits

Section 4(f) of the U.S. Department of Transportation Act of 1966 requires that the proposed use of land from a publicly-owned public park, recreation area, wildlife and/or waterfowl refuge, or any significant historic or archeological site by a transportation project is permissible only if there is no feasible and prudent alternative to the use. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) amended existing Section 4(f) legislation to simplify the processing and approval of projects that have only *de minimi*s impacts on lands protected by Section 4(f). *De minimis* impacts are defined as those that do not "adversely affect the activities, features and attributes" of the Section 4(f) resource.

A detailed analysis of the potential impacts on the public parklands, recreation and open space resources is presented in the *Preliminary Section 4(f) Evaluation Technical Report*.

The development of early resource inventories and conceptual engineering activities to keep the transit alignment within existing rights-of-way, as much as possible, helped to avoid and/or minimize the impacts on many of the public parklands and recreational areas by the proposed alternatives. Subsequent engineering activities would seek to further minimize impacts whenever practicable.

The MTA intends to pursue a finding of *de minimis* impact for the public parklands and recreational areas that have potential impacts from the Build Alternatives. The potential impacts are not expected to alter the use or function of the public parklands and recreational areas or impede access. The Purple Line would benefit park users by providing direct access to the parks by improved transit service.

Table 4.4-1 identifies the potential impacts on public parklands, by alternative. Subsequent sections describe potential impacts on trails, open spaces associated with schools, and other recreational facilities. There are no wildlife and recreation areas that have potential impacts from waterfowl refuges in the corridor.

Figure 4.4-1: Public Parks and Recreation Areas

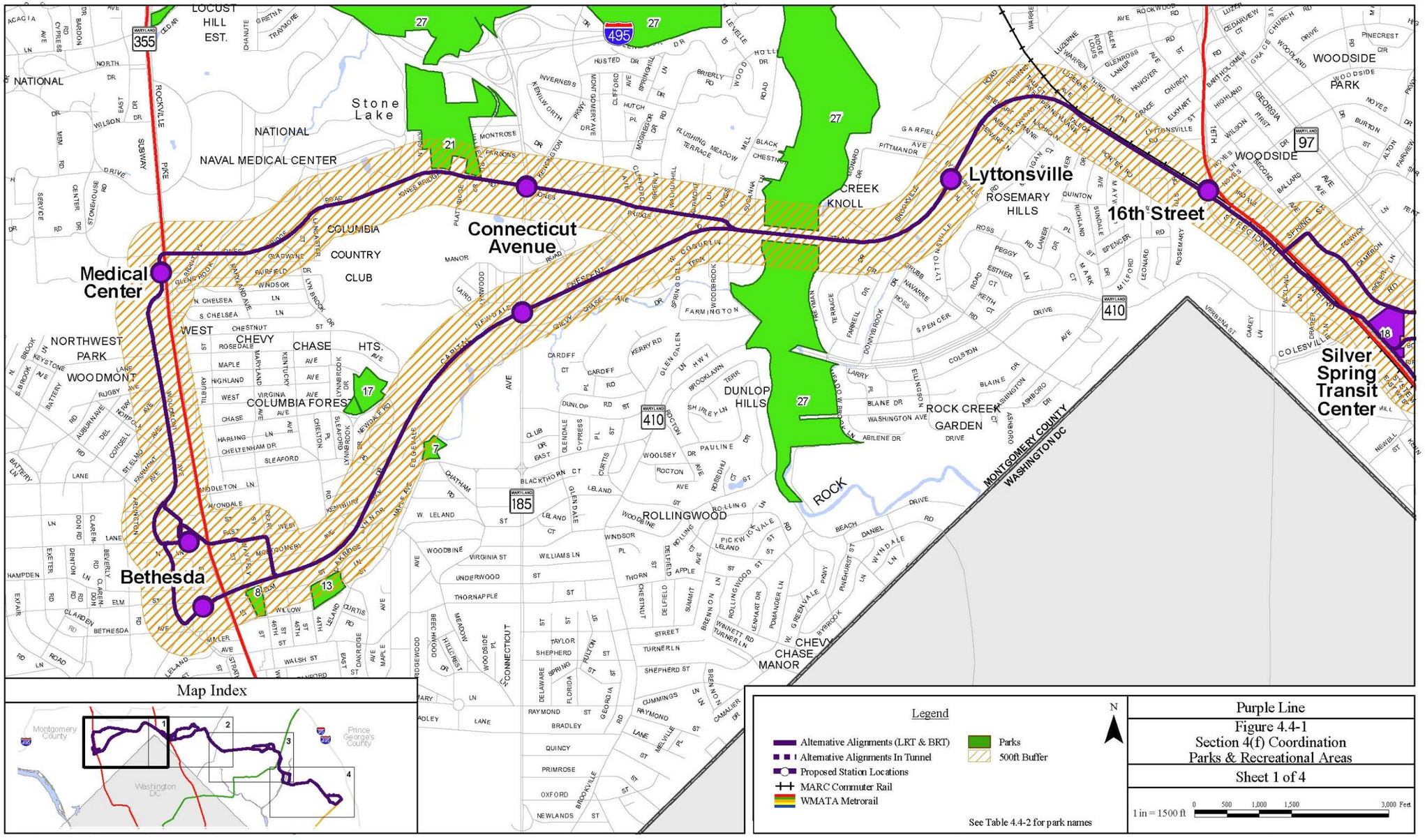


Figure 4.4-1: Public Parks and Recreation Areas (continued)

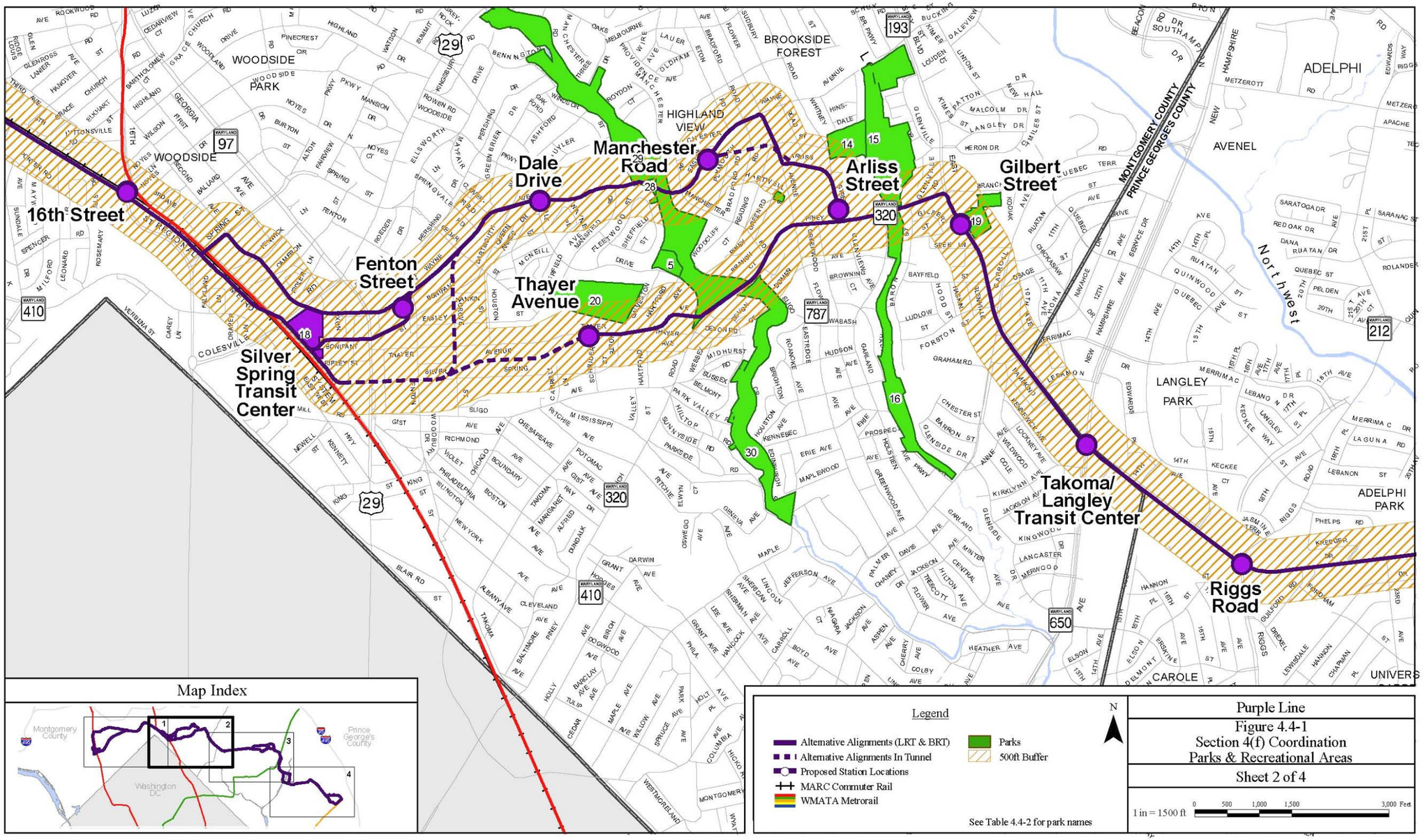


Figure 4.4-1: Public Parks and Recreation Areas (continued)

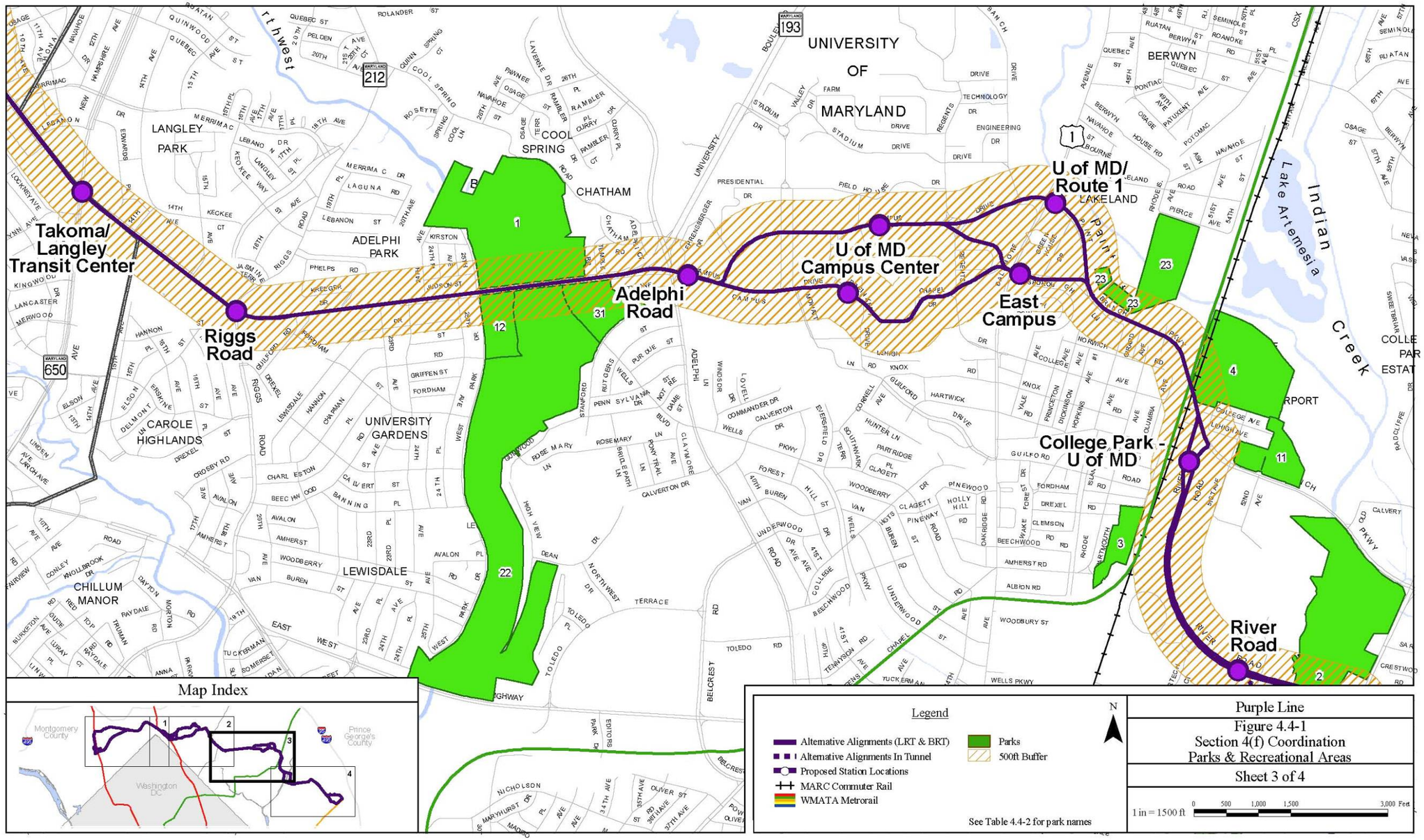


Figure 4.4-1: Public Parks and Recreation Areas (continued)

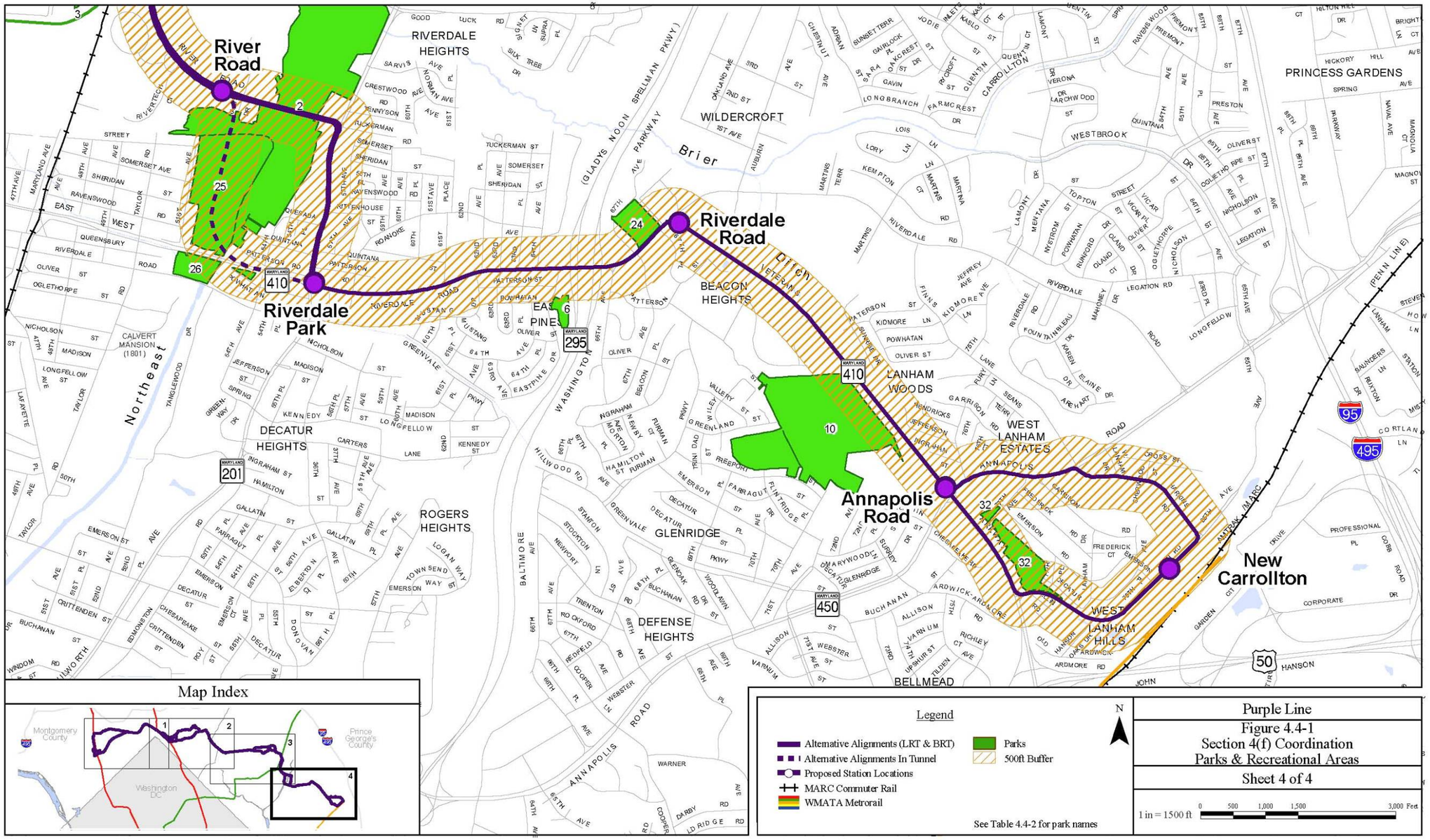


Table 4.4-1: Potential Direct Use of Public Parklands and Recreational Areas

Public Parklands – Potential Impact (Acres)																					
Name	Total Size (Acres)	No Build	TSM	Low Inv BRT	Percent of Total	Med Inv BRT	Percent of Total	Med BRT Preinkert/ Chapel Option	Percent of Total	High Inv BRT	Percent of Total	High BRT SS/ Thayer Option	Percent of Total	Low Inv LRT	Percent of Total	Med Inv LRT	Percent of Total	Med LRT Preinkert/Chapel Option	Percent of Total	High Inv LRT	Percent of Total	High LRT SS/ Thayer Option	Percent of Total
North Chevy Chase Local Park	32	No Impact	No Impact	0.02	0.06%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%	0.00	0.00%
Sligo Creek Stream Valley Park - Unit 2	39			0.43	1.10%	0.90	2.31%	0.90	2.31%	0.73	1.87%	0.78	2.01%	0.73	1.87%	0.90	2.31%	0.90	2.31%	0.73	1.87%	0.78	2.01%
Long Branch Local Park	14			0.01	0.07%	0.01	0.07%	0.01	0.10%	0.06	0.45%	0.06	0.45%	0.06	0.43%	0.06	0.45%	0.06	0.45%	0.06	0.45%	0.06	0.45%
New Hampshire Estates Neighborhood Park	5			0.05	0.99%	0.05	0.99%	0.05	0.99%	0.14	2.79%	0.14	2.80%	0.14	2.79%	0.14	2.89%	0.14	2.89%	0.14	2.79%	0.14	2.79%
Adelphi Manor Community Recreation Center	34			0.07	0.21%	0.07	0.21%	0.07	0.21%	0.03	0.10%	0.03	0.10%	0.03	0.10%	0.07	0.20%	0.07	0.20%	0.03	0.10%	0.03	0.10%
Northwest Branch Stream Valley Park	519			0.36	0.07%	0.36	0.07%	0.36	0.07%	0.25	0.05%	0.25	0.05%	0.25	0.05%	0.25	0.05%	0.25	0.05%	0.25	0.05%	0.25	0.05%
University Hills Neighborhood Park	7			0.06	0.86%	0.06	0.86%	0.06	0.86%	0.02	0.25%	0.02	0.25%	0.02	0.25%	0.02	0.25%	0.02	0.25%	0.02	0.25%	0.02	0.25%
College Park Airport	34			0.004	0.01%	0.004	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%	0.005	0.01%
Anacostia River Stream Valley Park	794			0.65	0.08%	0.65	0.08%	0.65	0.08%	0.00	0.00%	0.00	0.00%	0.65	0.08%	0.65	0.08%	0.65	0.08%	0.00	0.00%	0.00	0.00%
Park Police Headquarters	6			0.44	7.3%	0.45	7.5%	0.45	7.5%	0.45	7.5%	0.45	7.5%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
W. Lanham Hills Neighborhood Recreation Center	9			0.00	0.00%	0.46	5.11%	0.46	5.11%	0.46	5.11%	0.46	5.11%	0.00	0.00%	0.27	2.95%	0.27	2.95%	0.27	2.94%	0.27	2.94%
Total	---			**2.09**	---	**3.02**	---	**3.02**	---	**2.09**	---	**2.15**	---	**1.98**	---	**2.38**	---	**2.38**	---	**1.51**	---	**1.57**	---

Table 4.4-1: Potential Direct Use of Public Parklands and Recreational Areas (continued)

Recreational Trails – Potential Impact (Miles)

Name	Total Length (Miles)	No Build	TSM	Low Inv BRT	Percent of Total	Med Inv BRT	Percent of Total	Med BRT Preinkert/ Chapel Option	Percent of Total	High Inv BRT	Percent of Total	High BRT SS/ Thayer Option	Percent of Total	Low Inv LRT	Percent of Total	Med Inv LRT	Percent of Total	Med LRT Preinkert/ Chapel Option	Percent of Total	High Inv LRT	Percent of Total	High LRT SS/ Thayer Option	Percent of Total
Interim Georgetown Branch Trail *	5	No Impact	No Impact	1.57	34%	1.23	27%	1.23	27%	1.19	26%	1.19	26%	1.65	36%	1.67	36%	1.67	36%	1.62	35%	1.62	35%
Sligo Creek Trail	10			0.04	0%	0.06	1%	0.06	1%	0.06	1%	0.02	0%	0.06	1%	0.06	1%	0.06	1%	0.06	1%	0.02	0%
Rock Creek Trail	19			0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%	0.03	0%
Northwest Branch Trail	16			0.02	0%	0.02	0%	0.03	0%	0.02	0%	0.02	0%	0.02	0%	0.02	0%	0.03	0%	0.02	0%	0.02	0%
Northeast Branch Trail	3			0.03	1%	0.03	1%	0.03	1%	0.02	0%	0.02	0%	0.04	1%	0.04	1%	0.04	1%	0.02	0%	0.02	1%
Paint Branch Trail	4			0.00	0%	0.03	0%	0.03	0%	0.02	0%	0.02	0%	0.04	0%	0.04	0%	0.04	0%	0.04	0%	0.04	1%
Total	---			**1.69**	---	**1.39**	---	**1.39**	---	**1.33**	---	**1.29**	---	**1.82**	---	**1.85**	---	**1.85**	---	**1.78**	---	**1.74**	---

Open Space (Public Schools) – Potential Impact (Acres)

Name	Total Size (Acres)	No Build	TSM	Low Inv BRT	Percent of Total	Med Inv BRT	Percent of Total	Med BRT Preinkert/ Chapel Option	Percent of Total	High Inv BRT	Percent of Total	High BRT SS/ Thayer Option	Percent of Total	Low Inv LRT	Percent of Total	Med Inv LRT	Percent of Total	Med LRT Preinkert / Chapel Option	Percent of Total	High Inv LRT	Percent of Total	High LRT SS/ Thayer Option	Percent of Total
North Chevy Chase ES	8	No Impact	No Impact	0.28	4%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	0.00	0%
Sligo Creek ES and Silver Spring International MS	16			0.03	0%	0.08	1%	0.08	1%	0.05	0%	0.00	0%	0.05	0%	0.36	2%	0.36	2%	0.05	0%	0.00	0%
East Silver Spring ES	9			0.00	0%	0.00	0%	0.00	0%	0.00	0%	1.65	19%	0.00	0%	0.00	0%	0.00	0%	0.00	0%	1.65	19%
Rosemary Hills ES	7			0.24	4%	0.28	4%	0.28	4%	0.28	4%	0.28	4%	0.32	5%	0.32	5%	0.32	5%	0.32	5%	0.32	5%
University of Maryland	1,500			13.91	1%	10.62	1%	7.02	0%	9.58	1%	9.58	1%	11.08	1%	11.08	1%	7.21	0%	9.58	1%	9.58	1%
Total	---			**14.46**	---	**10.98**	---	**7.38**	---	**9.58**	---	**11.51**	---	**11.46**	---	**11.40**	---	**9.96**	---	**9.96**	---	**11.55**	---

Notes: * Montgomery County reserved the Georgetown Branch for transportation use; therefore, the impacts are not subject to Section 4(f) requirements.
Proposed Storage and Maintenance Facilities at Lyttonsville and Glenridge do not impact public parklands and recreational areas because they are existing maintenance sites.
All potential impacts based on conceptual engineering available to date and subject to change. Official GIS data not available for trail resources at this time. Potential impacts on trails are estimated based on readily available information and subject to change.

Impacts can range from direct property impacts, where acquisition of park and recreation area property is required, to proximity impacts (changes is access, visual character, noise, vibration, etc) and temporary easements impacts, usually due to construction needs.

The LRT alternatives would have no impact per FTA guidelines on noise in the public parklands and recreational areas, trails, and public school properties identified as noise sensitive areas, due largely to the presence of vehicle skirts placed on all Purple Line light rail vehicles.

The BRT alternatives would have no noise impacts at the public parklands and recreational areas.

Visually sensitive areas are defined as those where viewers are likely to notice changes. In general, parks, trails, and natural areas contain areas of high visual sensitivity. Development within or near parks, trails and natural areas is likely to be noticed more than development in more urbanized environments. Generally, the Build Alternatives travel along existing roads and are considered compatible with the original character of the roadways and communities along the alignment. Most of the roadways are arterials and already have a number of frequently operating bus routes on them. Therefore, the BRT alternatives would likely have limited visual effects. LRT and its required infrastructure (rails, catenary wires, and traction power substations) would have a greater effect, but would still be suitable to the corridor. Fencing and lighting would be located where needed, for safety reasons. These elements would cause potential visual effects for the adjacent land uses and recreational users.

The Build Alternatives would involve construction along existing roadways and along new rights-of-way in selected areas. Potential construction impacts would extend through the construction period and include temporary air emissions, fugitive dust, noise and vibration from construction equipment, temporary interruptions to vehicular and pedestrian traffic, temporary loss of on-street parking, and temporary loss of utility services. Construction-related effects associated with tunnel alignments would be more substantial compared with surface alignments.

Construction activities would result in temporary interruptions to both vehicular and pedestrian access to public parklands and recreational areas. For public safety reasons, access to construction areas will be restricted. In those cases where the Build Alternatives impact existing access locations, the project will relocate access in other areas. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Access to public parklands and recreational areas would be maintained to the maximum extent possible, and access for fire and emergency vehicles would be maintained at all times**.**

Public Parklands

The Purple Line is anticipated to require right-of-way or have other impacts on 11 public parklands, five open space areas (schools) and five trails. This section describes preliminary impacts for public parklands and recreational areas. The impacts identified for each resource will most likely be lower than this “worst-case” analysis, as the design is refined during the subsequent detailed engineering phase for a Locally Preferred Alternative.

The Build Alternatives cross four large linear parks on existing roadways: Sligo Creek Stream Valley Park, Long Branch Local Park, Northwest Branch Stream Valley Park, and Anacostia River Stream Valley Park. The roadways on which the Purple Line would operate as it crosses Long Branch, Northwest Branch, and Anacostia River parks are four lanes wide, heavily traveled, and are currently used by buses. Therefore, the addition of LRT or BRT in these areas would not represent a major change in visual conditions.

North Chevy Chase Local Park, owned by M-NCPPC - Montgomery County, is located on Jones Bridge Road in Chevy Chase. Recreational facilities at the park include athletic fields, a community center, courts, and water activities. Low Investment BRT would impact approximately 0.02 acre of this 32-acre property but would not affect the recreational facilities. All other alternatives would not impact this property.

Sligo Creek Stream Valley Park, owned by M-NCPPC - Montgomery County, contains two units within the corridor. Unit 1, 37 acres in size, extends from Chaney Drive northwest to Piney Branch Road in Takoma Park, Maryland. Unit 2, 39 acres in size, extends from Piney Branch Road northwest to MD 29 in Four Corners, Maryland. The entire stream valley park system totals over 200 acres. Recreational facilities at the park include playgrounds, athletic fields, courts, a trail, and picnic areas. All of the Build Alternatives would impact between 0.43 and 0.90 acre of this stream valley park but would not affect the recreational facilities.

Long Branch Local Park, owned by M-NCPPC - Montgomery County, is located on Piney Branch Road in Silver Spring, Maryland. Recreational facilities it this park include playgrounds, athletic fields, courts, and picnic areas. All of the Build Alternatives would impact between 0.01 and 0.06 acre of this 14-acre property but would not affect the recreational facilities.

New Hampshire Estates Neighborhood Park, owned by M-NCPPC - Montgomery County, is located on Piney Branch Road in Takoma Park, Maryland. Recreational facilities it this park include playgrounds, athletic fields, and picnic areas. All of the Build Alternatives would impact between 0.05 and 0.14 acre along the edge of this almost five-acre property including the brick columns, walkways, and benches but would not affect the recreational facilities. The brick columns, walkways, and benches would be relocated.

Note that within Montgomery County the Build Alternatives are not expected to have direct property impacts to Elm Street Urban Park, Metro Urban Park, or Rock Creek Regional Park. The Build Alternatives include a hiker-biker trail that would follow an existing signed bike route within and along the northwest edge of Elm Street Urban Park that connects with the Capital Crescent Trail. Since permanent extension of the Capital Crescent Trail as part of the Purple Line would follow the existing bike route, it would not impact this property. Metro Urban Park is one of several small gathering spaces in downtown Silver Spring. Montgomery County would remove this park as part of the Silver Spring Transit Center project. Therefore, the Purple Line would not affect this property. All of the alignments cross Rock Creek Regional Park within the County-owned Georgetown Branch right-of-way and would not require park property.

Adelphi Manor Community Recreation Center, owned by M-NCPPC – Prince George’s County, a 34-acre recreational area, is located along MD 193 in College Park on the west side of the Northwest Branch of the Anacostia River. Recreational facilities at this park include playgrounds, athletic fields, a trail, and picnic areas. All of the Build Alternatives would impact between 0.03 and 0.07 acre of this property but would not affect the recreational facilities.

Northwest Branch Stream Valley Park, owned by M-NCPPC – Montgomery and Prince George’s Counties, consists of 519 acres located north and south of MD 193 and encompasses a number of community parks. Recreational facilities at this park include playgrounds, a community center,

and a trail. All of the Build Alternatives would impact between 0.25 and 0.36 acre along the park boundaries but would not affect the recreational facilities at Adelphi Manor or Lane Manor Community Recreation Centers.

University Hills Neighborhood Park, owned by M-NCPPC – Prince George's County, is an approximately seven-acre facility located in Adelphi. Recreational facilities at this park include playgrounds, athletic fields, courts, a trail, a shelter, picnic areas and water activities. All of the Build Alternatives would impact between 0.02 and 0.06 acre of this property but would not affect the recreational facilities.

College Park Airport, owned by M-NCPPC – Prince George's County, the world's oldest continuously operating airport, encompasses 34 acres of land in College Park. This airport is used by private airplanes only, and contains a museum of aviation history. All of the Build Alternatives would impact up to 0.005 acre along the edge of the property but would not affect the recreational facilities.

Anacostia River Stream Valley Park, owned by M-NCPPC – Prince George's County, encompasses 794 acres and a number of community parks. Recreational facilities at this park include playgrounds, athletic fields, a community center, courts, and a trail. Low and Medium Investment BRT and LRT would impact up to 0.65 acre of the park along River Road but would not affect the recreational facilities at Riverdale Community Recreation Center. The High Investment BRT and LRT would travel under the park in a tunnel and would not impact the park or recreational facilities.

Park Police Headquarters, owned by Prince George's County, is located at 6700 Riverdale Road, Riverdale. The headquarters building sits on almost six acres of land. This property does not include recreational facilities. The BRT alternatives would impact up to 0.45 acre of land, an access road, and semi-circular drive off of Riverdale Road. The LRT alternatives would not affect this property.

West Lanham Hills Neighborhood Recreation Center, owned by M-NCPPC – Prince George's County, is a nine-acre facility located in Landover Hills. Recreational facilities at this park include playgrounds, a community center, courts, a trail, and shelters. All of the Build Alternatives, except Low Investment BRT and LRT, would impact up to 0.46 acre along the park's southern boundary but would not affect the recreational facilities.

Note that the Build Alternatives would impact the Glenridge Community Park/Northern Area Maintenance Office, a 62- acre site. The proposed Purple Line maintenance and storage facility would be built on the 10.5 acres of this site that are currently being used for park maintenance and storage activities. The Purple Line maintenance and storage facility would not require additional property from the Glenridge Community Park. Recreational facilities at this park include a playground, athletic fields, courts, a trail, shelters, picnic areas, and water activities.

Recreational Trails

In addition to the future Capital Crescent Trail (currently the Interim Georgetown Branch Tai) much of which runs parallel to the Purple Line, the Purple Line would cross and potentially impact five trails.

The Interim Georgetown Branch Trail, owned by M-NCPPC – Montgomery County, extends from Bethesda to Silver Spring. It consists of two sections. The western portion is in an abandoned railroad right-of-way purchased by Montgomery County in 1988. This 3-mile portion is made of crushed stone. The eastern section consists of a 1.6-mile signed bike route, connecting Silver Spring to the crushed stone trail in Lyttonsville. All of the Purple Line alternatives would use at least some of the route, impacting between 1.19 and 1.67 miles of the Interim Georgetown Branch Trail. The Purple line, if constructed in the Georgetown Branch right-of-way, would include construction of a permanent trail. The Georgetown Branch right-of-way was purchased with the intention to provide a corridor for transit use, unlike the other recreational facilities in the corridor whose primary purpose is for recreational use. Therefore, the Interim Georgetown Branch Trail would not be subject to Section 4(f) requirements.

All of the Build Alternatives would have visual changes to the Interim Georgetown Branch Trail. The Purple Line would result in substantial visual effects to the visual character of the Interim Georgetown Branch Trail due to the presence of the Purple Line in the Georgetown Branch right-of-way and the required clearing of trees and other vegetation for construction. While new landscaping would be included in the construction, the mature trees would not be replaced. The clearing of vegetation for construction would reduce screening of the right-of-way from neighboring land uses.

Construction of the transitway and a permanent trail would incorporate new landscaping. The MTA has made a number of design modifications to minimize the related effects in consideration of this visually sensitive area. These modifications include moving the trail to the north side of the alignment between Pearl Street and just west of Jones Mill Road. Following the existing topography, which is higher on the north side, allows for a natural placement of the transitway three to four feet below the level of the trail, creating a more pleasant experience for the trail user and minimizing the required retaining walls. A goal of providing a 10-foot buffer of landscaping between the trail and the transitway has been added to further improve the experience of trail users. The MTA is also considering the use of grass tracks to maintain a more natural character of the right-of-way.

The Build Alternatives would result in access changes to the Georgetown Branch Trail. Currently when trail users need to cross the transitway they do so where ever they please, the inclusion of the Purple Line in the right-of way mean that they are required to do so at formal access points. Beneficial effects include the fact that once constructed the trail would be ADA compliant and the access points would be enhanced

The Rock Creek Trail, owned by M-NCPPC – Montgomery County, is a 19-mile, paved surface hiker-biker trail, located primarily within Rock Creek Stream Valley Park. The Purple Line would cross the Rock Creek Trail on a bridge and provide a "switchback" connection from the permanent Capital Crescent Trail to the Rock Creek Trail. The switchback would serve to keep the sloping connection at a low enough grade to comply with Americans with Disabilities Act (ADA) guidelines. This ramp would enhance access from the Capital Crescent Trail to the Rock Creek Trail and Park by providing a gently sloping connection between the two trails. All alternatives would impact about 0.03 mile of this facility. The recreational use of the trail would be beneficially affected by the connection to the permanent Capital Crescent Trail and would not be adversely affect by the crossing.

The Sligo Creek Trail, owned by M-NCPPC – Montgomery and Prince George's Counties, extends from Hermitage Avenue at its northern end, ending just north of the Montgomery County/Prince George's County line. The trail primarily runs through Sligo Creek Stream Valley Park and is about 10 miles in length. All of the Purple Line alternatives cross the Sligo Creek Trail on Wayne Avenue, except the Silver Spring/Thayer design option, which would cross the trail on Piney Branch Road. Impacts to the

Sligo Creek Trail would be between 0.02 and 0.06 mile. The recreational use of the trail would not be affected.

The crossing of Sligo Creek Parkway on Wayne Avenue would require widening of the existing bridge, which would represent a visual effect.

If the High Investment BRT or LRT Silver Spring/Thayer Avenue design option were selected, the aerial structure required for the LRT on Piney Branch Road for the same design option would result in substantial visual changes both for users for the Sligo Creek Trail.

Northwest Branch Trail owned by M-NCPPC – Montgomery and Prince George's Counties, extends 16 miles north and south of the Capital Beltway in the Northwest Stream Valley Park. The Purple Line alignments cross this park and trail on University Boulevard and could impact up to 0.03 mile of this trail with the widening of the roadway. The recreational use of the trail would not be affected.

The Northeast Branch Trail, owned by M-NCPPC – Prince George's County, is part of the Anacostia Tributary Trail system and runs north south in the Anacostia Stream Valley Park. The required widening of the bridge that carries River Road over the existing trail under High Investment BRT and all LRT alternatives would impact 0.02 to 0.04 mile of the trail. The recreational use of the trail would not be affected.

Public Schools

The Purple Line potentially could impact five public school properties. The Build Alternatives could result in access changes to several school properties. These impacts would be mitigated by relocating access points, as necessary, so that overall access to these resources does not substantially change.

North Chevy Chase Elementary School is located at the intersection of Jones Bridge Road and Montgomery Avenue in Chevy Chase. Low Investment BRT would travel along Jones Bridge Road along the front, north side of the school property but would not affect its recreational facilities, which include playgrounds and athletic fields. This alternative includes roadway widening impacting 0.28 acre of property (a strip take) and crossing four vehicular entrances north of the facility that provide access from Jones Bridge Road. The westernmost vehicular entrance leads to a parking lot on the west side of the school and a court located on the south side of the school. Two of the three other entrances lead to a semi-circular driveway that provides access to the main entrance of the school. School buses serving this school use this entrance. In addition, other school buses use this loop to turn around.

The fourth entrance provides access to a parking lot on the north side of school. The north side parking lot contains another entrance that provides alternate access to the school and would not be affected by the Purple Line. Vehicle access and pedestrian connections would be relocated, as needed.

Rosemary Hills Elementary School is located on Porter Road in Silver Spring. All of the Build Alternatives would impact 0.28 to 0.32 acre of the school property but would not affect its recreational facilities, which include playgrounds and athletic fields.

Sligo Creek Elementary School and Silver Spring International Middle School are two individual schools that share the same building and property located on Wayne Avenue in Silver Spring. All of the Build Alternatives, except the High Investment BRT and LRT Silver Spring/Thayer Avenue design option, would impact 0.03 and 0.36 acre along Wayne Avenue. The Purple Line would not affect the schools' recreational facilities, which include playgrounds and athletic fields. The alternatives would cross a driveway leading to a parking lot and a sidewalk from Wayne Avenue to the south entrance of the school. Vehicle access to the parking lot would be relocated to Dale Drive and pedestrian connections would be relocated as needed.

The BRT alternatives would have noise impacts at the Sligo Creek Elementary School and Silver Spring International Middle School properties which exhibited a 2 to 4 dBA increase in noise (moderate effect per FTA guidelines) under all of the BRT alternatives except for Low Investment BRT near Sligo Creek Elementary School (no impact). Appropriate mitigation measures for potential noise impacts would be determined following the selection of a Locally Preferred Alternative.

East Silver Spring Elementary School is located along Silver Spring Avenue in Silver Spring. The BRT and LRT Silver Spring/Thayer Avenue design option would impact 1.65 acres along the northeast corner of the facility. The alignment would cross a pedestrian walkway which provides access to and from Thayer Avenue, north of the facility. The pedestrian walkway would be relocated to allow for safe pedestrian access to the school from the north. The alignment is in close proximity to an existing concrete playground facility with a basketball court but is not expected to impact these recreational facilities. East Silver Spring Elementary School also includes playgrounds and athletic fields, which will not be impacted by the Purple Line.

University of Maryland is located in College Park and encompasses 1,500 acres. The Purple Line would cross Adelphi Road and travel along Campus Drive through the center of the campus, along Union Drive, and to US 1. The Purple Line would cross many sidewalks and vehicular entrances to parking lots and within the campus on both the north and south side. Vehicle access and pedestrian connections would be relocated, as needed. East of US 1, the alignments follow Paint Branch Parkway along the contours of University of Maryland property on the northeast side of the roadway. Total impacts for all of the alternatives on University of Maryland property range from approximately 7.02 to 13.91 acres.

All of the Purple Line alternatives, except Low Investment BRT and the Preinkert/Chapel Drive design option, would travel south of the James H. Kehoe Track & Field Facility and Ludwig Field to connect with US 1. There are existing long jump and high jump facilities in this area. However, the University of Maryland *Facilities Master Plan 2001-2020* proposes to relocate the track & field facility, extend Union Drive to connect with Presidential Drive, and redevelop this entire area to fulfill its long-range vision for a mixed-use, "western gateway" to the campus. The University of Maryland incorporates the Purple Line in its *Facilities Master Plan.* While the Master Plan does not explicitly identify the location of the Purple Line one of the objectives for meeting the goal of maximizing use of alternatives to driving to campus alone is "Support Purple Line stations on or adjacent to campus".

East of US 1, Low Investment BRT follows Paint Branch Parkway along the contours of University of Maryland property on the northeast side of the roadway. Total impacts for all of the alternatives on University of Maryland property range from approximately 7.02 to 13.91 acres.

Other Recreational Facilities

All of the alternatives would require altering the features of the Columbia Country Club golf course that has encroached upon the County-owned Georgetown Branch right-of-way. The Columbia Country Club is eligible for the National Register, and as such is a Section 4(f)

historic resource. These alterations would include relocation and reconstruction of two golf cart underpasses and a cart path along the 15th hole, and reconfiguration of golf course features to remove them from the right-of-way. The rail bed would be raised, primarily in the eastern half of the segment that passes through the country club. At this location, retaining walls with fencing would be built along both sides of the widened rail bed within the right-of-way. Refer to the *Architectural History Technical Report* and the *Preliminary Section 4(f) Evaluation Technical Report* for further information on this resource.

There would be no impact on the Rock Creek Pool and Tennis Club.

4.4.3. Consultation and Coordination

The NEPA and Section 4(f) processes require consultation with the federal, State, or local officials having jurisdiction over the park, recreation area, refuge, or significant historic or archaeological resource. Coordination encompasses the identification, analysis, and potential impacts on Section 4(f) resources. The M-NCPPC (for both Montgomery and Prince George's counties) and the State Historic Preservation Office (SHPO) are the primary agencies with jurisdiction over the public parklands and recreational areas in the corridor. Table 4.4-2 summarizes the consultation and coordination activities that have taken place to date.

Table 4.4-2: Summary of Coordination Activities

Public Involvement Opportunity	Attendees	Date(s)	Major Topics/Issues
Coordination Meeting	Columbia Country Club, MHT, and Project Team	February 25, 2003	Concerns about effects on CCC greens located within the County-owned right-of-way, maintenance of golf cart crossings across right-of-way
Notice of Intent	N/A	September 3, 2003	N/A
Scoping Meeting	Environmental Agencies, General Public	Sept. 10, 16, 17, 24, 2003 September 25, 2003	Public scoping Agency scoping
Coordination Meeting	Columbia Country Club, Project Team	November 11, 2004	MTA conceptual plans for trail and transitway within County-owned right-of-way
Interagency Coordination Meetings	DNR, M-NCPPC	October 1, 2004 April 29, 2005 April 7, 2006	Project updates Alignment reviews
Field Reconnaissance Meetings	Environmental Agencies	December 2, 2003 November 8, 2007	Alignment review Alignment review
Public Open Houses	Environmental Agencies, General Public Columbia Country Club, Project Team	November 8, 10, 15, 16, 17, 2004 June 12, 14, 19, 21, 2006 December 3, 5, 10, 12, 13, 2007 May 8, 12, 14, 15, 21, 2008	Informational Meetings May 2008 - Request from County Club for detailed project plans
Master Plan Community Focus Group Meetings	Columbia Country Club, Project Team, local stakeholders	Fall 2005 - May 2008	Project updates
Public Parks Meeting	M-NCPPC, Project Team	October 25, 2007 November 15, 2007	Historic context and funding of parks
Section 4(f)/Section 106 Cultural Resources Meetings	SHPO, Project Team	November 8, 2007	Confirmation of review/approval procedures for cultural resources

Coordination Meetings

The MTA met with the M-NCPPC and the SHPO at various times to confirm research and inventory data, review the alternatives and options under consideration, and discuss potential impacts and mitigation measures. Additional discussions are anticipated to occur with the M-NCPPC and the SHPO regarding the project's potential impacts to Section 4(f) resources. Issues may include the M-NCPPC's input regarding the relative harm that would be caused by each of the alternatives and options under consideration, and mitigation measures that could lessen potential impacts.

The MTA has met with the Columbia Country Club several times regarding project plans. Meetings were held in February 2003 and November 2004. Topics discussed at these meetings included Country Club concerns about the effect on their greens located within the County-owned right-of-way, and the need to maintain access for golfers and golf carts across the right-of-way. The County Club was shown a number of conceptual plans for treatment of the transitway and trail within the right-of-way bordered by the Country Club. Representatives of the Country Club have attended the Master Plan Community Focus Groups and public open houses. At the Open House in May 2008 representatives of the County Club requested updated detailed maps showing the Purple Line plans and the existing topography.

Correspondence

Written correspondence was used to provide an official record of coordination, to verify data researched to date, and to solicit input from officials with jurisdiction over Section 4(f) resources. Refer to the *Preliminary Section 4(f) Evaluation Technical Report* for further information. Coordination will continue with these organizations throughout the NEPA process.

4.4.4. Measures to Avoid, Minimize, or Mitigate Harm

Measures to minimize harm have been investigated to reduce the potential impacts of the alternatives. The primary methods of avoiding impacts to public parklands and recreational areas have been staying within the transportation rights-of-way or relocating the alignments.

The primary measures to minimize or mitigate impacts to public parklands and recreational areas have included using retaining walls to reduce property acquisition, relocation of transit facilities (e.g., stations and ancillary facilities), and alignment modifications to reduce resource impacts. Additional measures to minimize impacts of the alternatives would be developed through coordination with the park owner and could include the following:

- Replacement land of equal or greater natural resource and economic value could be provided in a manner to be agreed upon by the park owner and the MTA.

- The careful use of erosion and sediment control measures to minimize water quality impacts.
- Additional appropriate mitigation measures such as landscaping (where applicable with respect to the resource).

Development of minimization and mitigation measures will occur during future phases of the project. These measures will be presented and discussed at project open houses, community meetings, and community focus groups in the future planning stages of the project.

4.5. Cultural Resources

Historic structures, archeological resources, and parklands may be affected by the proposed alternatives for the Purple Line. The regulatory framework governing cultural resources is described in the sections below. Quantitative data regarding the presence of resources that are listed, eligible, or potentially eligible for the National Register of Historic Places (NRHP) within the Area of Potential Effect (APE) is presented, as are preliminary assessments of the Purple Line's potential to create adverse effects on these historic properties. For more detail see the *Architectural History Technical Report*, and the *Phase Ia Archeological Assessment Survey Technical Report*.

4.5.1. Section 106 of the National Historic Preservation Act of 1966 (NHPA)

Section 106 of the National Historic Preservation Act of 1966 (as amended) requires federal agencies to consider the impacts of their project undertakings on historic architectural, archeological, and parkland resources that are either listed in the NRHP or eligible for listing (36 CFR. 800). If projects are federally permitted, licensed, funded, or partially funded, the project must comply with Section 106.

Consulting Parties

- Columbia Country Club
- Falklands Chase
- Friends of Sligo Creek
- Hawkins Lane Historic District
- Hawkins Lane Historic District Local Advisory Panel
- Historic Takoma
- Hyattsville Preservation Association
- Maryland-National Capital Parks and Planning Commission, Montgomery County
- Maryland-National Capital Parks and Planning Commission, Prince George's County
- Montgomery County Historic Preservation Commission
- Montgomery Preservation, Inc.
- National Institutes of Health, Office of Community Liaison
- National Naval Medical Center
- National Park Service
- North College Park Citizens Association
- Old Town College Park Preservation Association
- Peerless Rockville Historic Preservation, Ltd.
- Prince George's County Historical and Cultural Trust
- Prince George's County Historical Society
- Prince George's Heritage, Inc.
- Redevelopment Authority of Prince George's County
- Riverdale Historical Society
- Rockville Historic District Commission
- Silver Spring Historical Society
- University Hills Civic Association
- University of Maryland

Under Section 106, federal agencies are required to provide the public with information about a proposed project and its effect on historic properties and to seek public comment and input, except where confidentiality is considered necessary (as specified in 36 CFR Parts 800.2 and 800.3). As required by Section 106, consulting and interested parties for the Purple Line were identified and invited to discuss impacts to historic resources and provide comments on these potential impacts. The State Historic Preservation Officer (SHPO) is a consulting party; in Maryland, the SHPO is the Maryland Historical Trust (MHT). The consulting parties will participate in the development of a Memorandum of Agreement, should one be required, to address adverse impacts to historic resources. MTA will develop appropriate mitigation measures, after the selection of a Locally Preferred Alternative.

The public was provided with an opportunity to comment on the cultural resources identification and evaluation process at three rounds of public open houses held in June 2006, December 2007, and May 2008. These were held in Bethesda, Silver Spring, Takoma/Langley Park, College Park, and New Carrollton. An environmental resources map showing all recorded historic properties (NRHP and Maryland Inventory of Historic Properties) was on display at each public meeting. In addition, a display board explaining Section 106 and the public involvement process was provided.

4.5.2. Survey Methodology

In the early stages of project planning, an APE for the Purple Line was defined. This is the survey area where the Purple Line may directly or indirectly impact resources. Resources, including buildings, structures, objects, districts, and sites more than 50 years old, were evaluated for eligibility for listing in the National Register. In some cases more recently constructed resources may also be eligible. Resources were identified by reviewing previous inventories and surveys contained in the MHT's files, historic maps, archival records, aerial photographs, property deeds, construction information, and field reconnaissance. For the Purple Line, MTA and the SHPO agreed to treat potentially eligible resources as eligible while project planning occurs, in order to facilitate project progress.

A Phase Ia cultural resources sensitivity assessment for the western portion of the Purple Line corridor (Bethesda to Silver Spring) was performed in 2005. This initial investigation included identification and preliminary recommendations of eligibility for architectural resources located within a 500-foot buffer along each side of the proposed project alignment and archeological resources within a 250-foot buffer.

The majority of the western portion had undergone field survey during prior studies (Including the Georgetown Branch portion of the current APE between Bethesda and Silver Spring). However, during the current project, the MHT made the decision to defer additional field survey until a Locally Preferred Alternative has been selected. As a result, the investigation of the eastern portion of the project APE was limited to a Phase Ia archeological reconnaissance, which included examination of the state GIS database, site files, aerial photography and field reconnaissance.

The cultural resources Phase Ia reconnaissance survey utilized mapping, data, and resource information from the 2005 study and additional field reconnaissance and photographic documentation. Preliminary determinations of eligibility and/or effect were made for properties that were either listed, previously determined eligible for listing, or newly identified resources

considered eligible for listing in the National Register.

4.5.3. Survey Results for Historic Standing Structures

A total of 261 properties were identified within the APE (see Table 4.5-1 and Figure 4.5-1). Of the 49 National Register-listed, eligible, or potentially eligible properties, it is anticipated that only one will be adversely affected because of substantial efforts to avoid and minimize adverse effects during the planning phase of the project. This single adverse effect will occur to the Falkland Apartments (M:36-12). Effects that are considered adverse include sites where right-of-way needs would result in property takings or changes that affect the character defining features of the resources.

4.5.4. Survey Results for Archaeological Resources

Fifteen archeological sites are present within the project APE. Information on these sites is included in Table 4.5-2. Of these 15 sites, ten have been the subject of determinations of eligibility; of these only two are either listed or eligible for inclusion in the National Register (the College Park Airport and the Taylor Site, respectively); and eight are determined ineligible. Eligibility has not been determined for the remaining five archeological sites, as there has not been enough information collected to date to make an eligibility determination. The preliminary Phase Ia Bi-County Transitway cultural resources survey conducted in 2005 identified 21 areas of prehistoric and historic archeological potential within the APE (Table 4.5-3). These areas of potential resources could contain relatively intact landforms or were portions of yards associated with former or extant historic structures.

National Register Listed Archaeological Resources within APE

College Park Airport (18PR200)

College Park Airport was established in 1909. Wilber Wright conducted training exercises at the field with military officers that flew the United States government's first airplane. College Park Airport is considered by many as the Cradle of Aviation. The airport was added to the National Register in 1977. A portion of the historic College Park Airport (NR: 436) was subjected to systematic archaeological investigation in 1980 as a compliance project related to planned airport redevelopment. The testing focused on the structural remains of four earlier hangars associated with the airport's early development. Although the project did yield artifacts associated with the airport's period of significance, there was no definitive determination as to whether these resources were contributory to the significance of this National Register-listed historic property.

National Register Eligible Archaeological Resources within APE

Taylor Site (18MO243)

The Taylor site is located in an area covered by grass and trees to the southeast of the National Institutes of Health campus on Wisconsin Avenue in Montgomery County. Although portions of the site have been disturbed, relatively intact portions of the site were identified. The site was found to contain a wide variety of prehistoric and late historic artifacts. The historic artifacts were linked to the development of the Town and Country Golf Club in the 1920s and were not considered significant.

The prehistoric artifacts recovered indicated a multi-component short-term resource procurement camp, with diagnostic tools and ceramics suggesting periodic occupation from the Late Archaic through Middle Woodland cultural periods. The site was identified as part of planning studies for proposed extension of Woodmont Avenue, the project was redesigned to avoid impacts, and the site is considered to retain potentially significant deposits. The Low Investment BRT Alternative along Woodmont Avenue is adjacent to this site. Should this alternative be selected, additional investigations will be undertaken to assess adjacent portions of the site so that impacts can be avoided or minimized.

Archaeological Resources within APE – National Register Status Not Determined

Clean Drinking Water Manor Site (18MO030)

Clean Drinking Water Manor was constructed in 1750 by Charles Jones. The structure was a brick-filled frame building measuring one-and-a-half stories. Records indicate that a cluster of brick outbuildings were constructed at the same time as the main manor house. These outbuildings included a kitchen, servants' quarters, and a well. A large portion of the Clean Drinking Water Manor Site was destroyed during construction of a nursing home and nearby roadways. However, beyond these construction disturbances, intact portions of the site may still exist and may contain structural remains as well as other features such as privies. When a Locally Preferred Alternative is selected, a Phase Ia sensitivity study may need to be conducted on the Clean Drinking Water Manor Site to determine site boundaries and limits of disturbance.

Trolley Bridge Site (18PR257)

The Trolley Bridge Site was identified during the Phase I archaeological survey of the Calvert Road Relocation in 1989. This bridge carried a local trolley over the Paint Branch drainage. The bridge was originally built in 1895 and was later structurally altered in the early twentieth century. The Trolley Bridge was a through-type girder bridge built by the Youngstown Bridge Company for the Columbia and Maryland Railway Company. Field observations during an earlier survey revealed that the bridge decking was gone and that the metal structure was suffering from severe corrosion. No subsurface testing was performed around the bridge at the time of the survey, so no determination of eligibility was made at that time. The site is essentially a standing bridge structure, and it is unlikely that any related significant cultural features exist around the abutments.

Engineering and Research Corporation Site (ERCO - 18PR258)

The ERCO site was identified during the Phase I archaeological survey of the Calvert Road Relocation in 1985. This site contains remnants of a late-twentieth century air field with standing structures and a runway associated with the World War II era. No subsurface excavations took place during an earlier survey, and only surface observation was completed. No determination of eligibility occurred during the survey. The structures and runway were determined eligible for the National Register in 2002. While the structures and runway may be significant mid-twentieth century historic resources, it is unlikely that archaeological investigation would yield any significant historical information about the complex that could not be obtained from archival sources. In addition, the limited archaeological potential of the site has been diminished by substantial development in the area.

Fire Site (18PR263)

The Fire Site was identified during the Phase I archaeological survey of the Calvert Road Relocation in 1985. This site contains a prehistoric quartzite lithic scatter. As part of a

Table 4.5-1: Properties More than Fifty Years Old

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
11	3351 Jones Bridge Road		Potentially Eligible	N
13	4100 Jones Bridge Road		Potentially Eligible	N
14	4419 East West Highway		Potentially Not Eligible	N
15	4421 East West Highway		Potentially Not Eligible	N
16	4425 Montgomery Avenue		Potentially Not Eligible	N
17	4804 Moorland Lane		Potentially Not Eligible	N
18	4900 Hampden Lane		Potentially Not Eligible	N
20	4963 Elm Street		Potentially Not Eligible	N
69	8700 Jones Mill Road		Potentially Not Eligible	N
73	8800 Platt Ridge Drive		Potentially Not Eligible	N
94	Altimont Lane Neighborhood		Potentially Not Eligible	N
96	Arlington Road Neighborhood		Potentially Not Eligible	N
97	Avondale Street Historic District		Potentially Eligible	N
98	Georgetown Branch, Bridge # 3	M:35-64	Not Eligible	N
101	Bethesda Cinema 'N' Drafthouse (Bethesda Theater)	M:35-14-04	Listed	N
102	Bethesda Naval Hospital Tower Block	M:35-08	Listed	N
261	National Naval Medical Center	M:35-98	Eligible	N
103	Bethesda Post Office (Darcy's Store)	M:35-14-05	Potentially Eligible	N
109	Brierly Court Neighborhood		Potentially Not Eligible	N
110	Brooks Photographers	M:35-14-06	Potentially Not Eligible	N
114	Chevy Chase Lake Apartments		Potentially Not Eligible	N
115	Chevy Chase Lake Trolley Station	M:35-11	No Longer Extant	N
124	Columbia Country Club	M:35-10	Eligible	N
125	Columbia Forest/Meadowbrook Village Subdivision		Potentially Not Eligible	N
126	Community Paint and Hardware	M:35-14-07	Potentially Eligible	N
127	Coquelin Terrace West Neighborhood		Potentially Not Eligible	N
131	Donneybrook Drive Neighborhood		Potentially Not Eligible	N
138	Elm Street Neighborhood		Potentially Not Eligible	N
154	Georgetown Branch Railroad	M:35-142	Not Eligible	N
155	Gladwyne Drive Neighborhood		Potentially Not Eligible	N
156	Glenbrook Neighborhood		Potentially Not Eligible	N
162	Hampden Lane Apartments		Potentially Not Eligible	N
163	Hampden Lane Neighborhood		Potentially Not Eligible	N
165	Hawkins Lane Historic District	M:35-54	Potentially Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
166	Howard Hughes Medical Institute		Potentially Not Eligible	N
167	Hurley-Sutton House	M: 35-56	Potentially Not Eligible	N
168	Jones Bridge Court Neighborhood		Potentially Not Eligible	N
169	Jones Bridge Road Cape Cod District		Potentially Not Eligible	N
170	King-Sutton House	M:35-55	Potentially Not Eligible	N
173	Leland Street Neighborhood		Potentially Not Eligible	N
175	Little Tavern (Bethesda)	M:35-14-03	Potentially Not Eligible	N
177	Longfellow Place Historic District		Potentially Eligible	N
178	Lynn Drive Neighborhood		Not Eligible	N
180	Madonna of the Trails	M:35-14-2	Potentially Eligible	N
182	MD 410 Near MD 355 Bridge, Bethesda (#15058)	M:35-60	No Longer Extant	N
186	Montgomery Avenue/Imiries Subdivision		Potentially Not Eligible	N
189	National Institutes of Health	M:35-9	Potentially Eligible	N
256	National Library of Medicine	M:35-9-8	Eligible	N
192	Newdale Mews Apartments		Potentially Not Eligible	N
193	North Chevy Chase Historic District		Potentially Eligible	N
194	Northwest Park Neighborhood		Potentially Not Eligible	N
195	Old Bethesda Commercial District	M:35-14	Potentially Eligible	N
200	Our Lady of Lourdes Church and School		Potentially Eligible	N
215	Rock Creek Knolls Neighborhood		Potentially Eligible	N
257	Rock Creek Park (within Maryland)		Potentially Eligible	N
216	Rock Creek Trestle	M:36-29	Not Eligible	N
232	Spring Valley Road Neighborhood		Potentially Not Eligible	N
234	Stewart Driveway Neighborhood		Potentially Not Eligible	N
235	Susanna Lane Neighborhood		Potentially Not Eligible	N
248	Walnut Hill Road Neighborhood		Potentially Not Eligible	N
251	West Lane Neighborhood		Potentially Not Eligible	N
256	Gilliland-Bloom House	M: 35-57	Potentially Eligible	N
1	1280 East West Highway		Potentially Not Eligible	N
2	1320 Fenwick Lane		Potentially Not Eligible	N
21	5 Devon Road		Potentially Not Eligible	N
22	531 Dale Drive		Potentially Not Eligible	N
45	8101 Georgia Avenue		Potentially Not Eligible	N
46	8113 Fenton Street		Potentially Eligible	N
47	815 Silver Spring Avenue		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
48	817 Easley Street		Potentially Not Eligible	N
49	818 Easley Street		Potentially Not Eligible	N
50	819 Silver Spring Avenue		Potentially Not Eligible	N
51	8201 Fenton Street		Potentially Not Eligible	N
52	8211 Fenton Street		Potentially Not Eligible	N
53	8225 Piney Branch Road		Potentially Not Eligible	N
54	8233 Fenton Street		Potentially Not Eligible	N
55	8237 Fenton Street		Potentially Not Eligible	N
56	8240 Fenton Street		Potentially Not Eligible	N
57	826 Wayne Avenue		Potentially Not Eligible	N
58	8301 Fenton Street		Potentially Not Eligible	N
59	8307 Fenton Street		Potentially Not Eligible	N
61	836 Bonifant Street		Potentially Not Eligible	N
62	8400 Fenton Street		Potentially Not Eligible	N
63	8402 Fenton Street		Potentially Not Eligible	N
64	8405 Ramsey Avenue		Potentially Not Eligible	N
65	8413 Ramsey Avenue		Potentially Not Eligible	N
66	8501 Colesville Road		Potentially Not Eligible	N
67	8580 Second Avenue		Potentially Not Eligible	N
68	8615 Ramsey Avenue		Potentially Not Eligible	N
70	8701 Ramsey Avenue		Potentially Not Eligible	N
71	8712 Piney Branch Road		Potentially Not Eligible	N
72	880 Bonifant Street		Potentially Not Eligible	N
74	8816 Glenville Road		Potentially Not Eligible	N
75	900 Wayne Avenue		Potentially Not Eligible	N
76	903 Bonifant Street		Potentially Not Eligible	N
77	904 Silver Spring Avenue		Potentially Not Eligible	N
78	905 Bonifant Street		Potentially Not Eligible	N
79	905 Silver Spring Avenue		Potentially Not Eligible	N
80	908 Thayer Avenue		Potentially Not Eligible	N
81	910 Silver Spring Avenue		Potentially Not Eligible	N
82	910 Thayer Avenue		Potentially Not Eligible	N
83	912 Silver Spring Avenue		Potentially Not Eligible	N
84	914 Thayer Avenue		Potentially Not Eligible	N
85	916 Thayer Avenue		Potentially Not Eligible	N
86	923 Sligo Avenue		Potentially Not Eligible	N
87	926 Wayne Avenue		Potentially Not Eligible	N
88	935 Bonifant Street		Potentially Not Eligible	N
89	949 Bonifant Street		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
90	954 Thayer Avenue		Potentially Not Eligible	N
91	959 Sligo Avenue		Potentially Not Eligible	N
104	Blair East Apartments		Potentially Not Eligible	N
105	Bonifant Street Rowhouses		Potentially Not Eligible	N
106	Bonifant Street Shops		Potentially Not Eligible	N
107	Bradford Road Apartments		Potentially Not Eligible	N
112	Canada Dry Building		Eligible	N
117	Church of the Ascension	M:36-25	Potentially Eligible	N
118	Cissel-Saxon American Legion Post #41		Potentially Not Eligible	N
129	Dale Drive Apartments		Potentially Not Eligible	N
130	Devon Road Neighborhood		Potentially Not Eligible	N
134	East Silver Spring Apartment District		Potentially Not Eligible	N
135	East Silver Spring Elementary School		Potentially Not Eligible	N
140	Ertter's Market		Potentially Not Eligible	N
141	Falkland Apartments	M:36-12	Eligible	Y
142	Fenton Street Bus Station		Potentially Not Eligible	N
143	Fenwick Lane Neighborhood		Potentially Not Eligible	N
144	Fenwick Professional Building		Potentially Not Eligible	N
147	First Baptist Church		Potentially Not Eligible	N
148	Fleetwood Terrace Neighborhood		Potentially Not Eligible	N
149	Flower Avenue Commercial District		Potentially Not Eligible	N
150	Flower Avenue North Historic District		Potentially Eligible	N
151	Flower Branch Apartments		Potentially Not Eligible	N
153	Foxhall Apartments		Potentially Not Eligible	N
159	Glenville Road Apartments		Potentially Not Eligible	N
160	Glenville Road Neighborhood		Potentially Not Eligible	N
164	Hartford Avenue Neighborhood		Potentially Not Eligible	N
176	Little Tavern (Silver Spring)	M:36-16	No Longer Extant	N
181	Manchester Road Apartment District		Potentially Not Eligible	N
184	Metropolitan Branch of the B&O Railroad	M:37-16	Eligible	N
185	Montgomery-Blair High School	M:36-21	Eligible	N
187	Montgomery County Police Station		Potentially Not Eligible	N
188	Montgomery Professional Building		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
196	Old Masonic Temple	M:36-17	Potentially Not Eligible	N
197	Old Silver Spring Commercial Historic District	M:36-07	Potentially Eligible	N
198	Old Silver Spring Post Office (U.S. Post Office)	M:36-11	Eligible	N
202	Park Valley Neighborhood		Potentially Not Eligible	N
204	Piney Branch and University Commercial District		Potentially Not Eligible	N
205	Piney Ridge Apartments		Potentially Not Eligible	N
208	Riggs-Thompson House	M:36-08	Potentially Eligible	N
210	Ripley Street Light Industrial Area		Potentially Not Eligible	N
217	Rolling Terrace Neighborhood		Potentially Not Eligible	N
219	Saint Michael's Church		Potentially Not Eligible	N
220	Saint Michael's School		Potentially Eligible	N
221	Section 3, North Woodside Subdivision		Potentially Not Eligible	N
224	Silver Spring and Fenton Building		Potentially Not Eligible	N
225	Silver Spring Avenue Neighborhood		Potentially Not Eligible	N
226	Silver Spring Park Historic District		Potentially Eligible	N
227	Silver Spring B&O Railroad Station	M:36-15	Listed	N
228	Sligo East Neighborhood		Potentially Not Eligible	N
230	Sligo Park Hills Commercial District		Potentially Not Eligible	N
231	Sligo Park Hills Neighborhood		Potentially Not Eligible	N
233	Springvale Terrace Apartments		Potentially Not Eligible	N
237	Talbot Avenue Bridge	M:36-30	Eligible	N
238	Tastee Diner		Potentially Not Eligible	N
249	Wayne Avenue Shops		Potentially Not Eligible	N
250	Wayne Avenue South Neighborhood		Potentially Not Eligible	N
254	Woodside Historic District	M:36-04	Eligible	N
255	Woodside Park Historic District	M:36-18	Potentially Eligible	N
3	1500 University Boulevard		Potentially Not Eligible	N
4	1600 University Boulevard		Potentially Not Eligible	N
5	1606 University Boulevard		Potentially Not Eligible	N
6	2020 University Boulevard		Potentially Not Eligible	N
7	2025 University Boulevard		Potentially Not Eligible	N
8	2074 University Boulevard		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
9	2201 University Boulevard		Potentially Not Eligible	N
10	2204 University Boulevard		Potentially Not Eligible	N
36	730 Seek Lane		Potentially Not Eligible	N
37	734 East University Boulevard		Potentially Not Eligible	N
44	807 East University Boulevard		Potentially Not Eligible	N
60	831 East University Boulevard		Potentially Not Eligible	N
92	Adelphi Manor Neighborhood		Potentially Not Eligible	N
93	Adelphi Plaza Shopping Center		Potentially Not Eligible	N
100	Barron Street Neighborhood		Potentially Not Eligible	N
113	Chatham Neighborhood		Potentially Not Eligible	N
116	Chillum-Adelphi Volunteer Fire Department Station		Potentially Not Eligible	N
119	Clifton Park Baptist Church		Potentially Not Eligible	N
120	Clifton Park Village Neighborhood		Potentially Not Eligible	N
152	Forest Laundromat		Potentially Not Eligible	N
161	Graduate Hills Apartments		Potentially Not Eligible	N
171	Langley Park Apartments		Potentially Not Eligible	N
174	Lewisdale Neighborhood		Potentially Not Eligible	N
183	Merrimac Drive Apartment District		Potentially Not Eligible	N
190	New Hampshire Estates Neighborhood		Potentially Not Eligible	N
191	New Hampshire Gardens Neighborhood		Potentially Not Eligible	N
222	Seek Lane Neighborhood		Potentially Not Eligible	N
223	Seventh Day Adventist Church		Potentially Not Eligible	N
229	Sligo Elementary School: Seventh Day Adventist		Potentially Eligible	N
236	Takoma-Langley Crossroads Commercial District		Potentially Not Eligible	N
243	University City Apartments		Potentially Not Eligible	N
244	University Gardens Apartments		Potentially Not Eligible	N
245	University Manor Apartments		Potentially Not Eligible	N
12	3617 Campus Drive		Potentially Not Eligible	N
40	7713 Adelphi Road		Potentially Not Eligible	N
41	7715 Adelphi Road		Potentially Not Eligible	N
123	College Park Airport	PG:66-4	Listed	N
199	Old Town College Park Historic District	PG:66-42	Potentially Eligible	N
201	Paint Branch Parkway		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
240	Trolley Line Bridge		Potentially Not Eligible	N
242	University Baptist Church		Potentially Not Eligible	N
246	University of Maryland, College Park	PG:66-35	Potentially Eligible	N
260	Rossborough Inn	PG:66-2	Potentially Eligible	N
259	Morrill Hall	PG:66-6	Potentially Eligible	N
247	University United Methodist Church		Potentially Not Eligible	N
19	4928 College Avenue		Potentially Not Eligible	N
23	5422 Quesada Street		Potentially Not Eligible	N
24	5701 Riverdale Road		Potentially Not Eligible	N
25	5801 Riverdale Road		Potentially Not Eligible	N
26	6000 67th Avenue		Potentially Not Eligible	N
27	6104 Kenilworth Avenue		Potentially Not Eligible	N
28	6105 57th Avenue		Potentially Not Eligible	N
29	6250 Kenilworth Avenue		Potentially Not Eligible	N
30	6300 Kenilworth Avenue		Potentially Not Eligible	N
31	6410 Kenilworth Avenue		Potentially Not Eligible	N
32	6507 Kenilworth Avenue		Potentially Eligible	N
33	66th and 67th Avenues Neighborhood		Potentially Not Eligible	N
34	66th Avenue Commercial Area		Potentially Not Eligible	N
35	6739 Riverdale Road		Potentially Not Eligible	N
99	Baltimore-Washington Parkway	PG:69-26	Listed	N
108	Bridge 16069	PG:68-84	Eligible	N
111	Calvert Hills Historic District	PG:66-37	Listed	N
121	College Avenue Light Industrial Area		Potentially Not Eligible	N
122	College Lawn Station Historic District	PG:66-3	Potentially Eligible	N
132	East Riverdale Neighborhood		Potentially Not Eligible	N

Table 4.5-1: Properties More than Fifty Years Old (continued)

Map ID Number	Property	Maryland Inventory of Historic Properties ID Number	National Register Eligibility	Adverse Effect
136	Eastpines Neighborhood		Potentially Not Eligible	N
137	Eastpines Shopping Center		Potentially Not Eligible	N
139	Engineering Research Corporation (ERCO)	PG:68-22	Potentially Eligible	N
145	Fernwood Gardens Apartments		Potentially Not Eligible	N
179	M-NCPPC Park Headquarters		Potentially Not Eligible	N
203	Parkview Gardens Apartments		Potentially Not Eligible	N
206	Powhatan Street Neighborhood		Potentially Not Eligible	N
207	Refreshing Spring Church of God in Christ		Potentially Not Eligible	N
209	Rinaldi Lanes Bowling Alley		Potentially Not Eligible	N
211	Riverdale Baptist Church	PG:69-12	Potentially Not Eligible	N
12	Riverdale Heights Neighborhood		Potentially Eligible	N
213	Riverdale Park East Neighborhood		Potentially Not Eligible	N
214	Riverdale Woods Neighborhood		Potentially Not Eligible	N
218	Saint Bernard's Catholic School		Potentially Not Eligible	N
239	Tennyson Street Neighborhood		Potentially Not Eligible	N
241	Tuckerman Street Neighborhood		Potentially Not Eligible	N
38	7503 Annapolis Road		Potentially Not Eligible	N
39	7519 Annapolis Road		Potentially Not Eligible	N
42	7729 Finns Lane		Potentially Not Eligible	N
43	7738 Annapolis Road		Potentially Not Eligible	N
95	Ardwick Historic Community	PG:69-23	Potentially Not Eligible	N
128	Cross Street Neighborhood		Potentially Not Eligible	N
133	East Riverdale Road Bungalow		Potentially Not Eligible	N
146	Fernwood Manor		Potentially Not Eligible	N
157	Glenridge Center Shopping Center		Potentially Not Eligible	N
158	Glenridge Elementary School		Potentially Not Eligible	N
172	Lanham Woods Historic District		Potentially Eligible	N
252	West Lanham Estates		Potentially Not Eligible	N
253	West Lanham Hills		Potentially Not Eligible	N

Figure 4.5-1: Properties More than Fifty Years Old

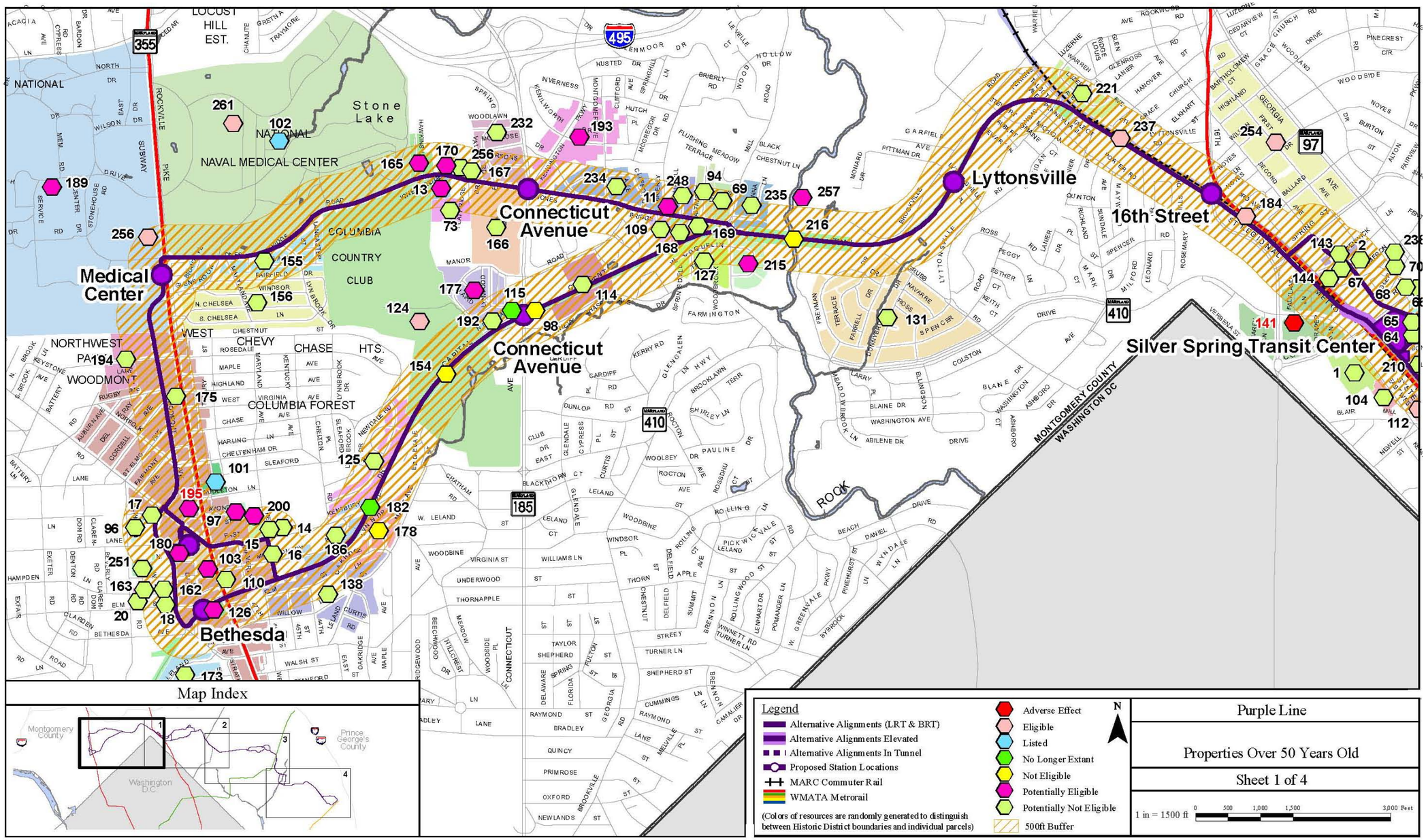


Figure 4.5-1: Properties More than Fifty Years Old (continued)

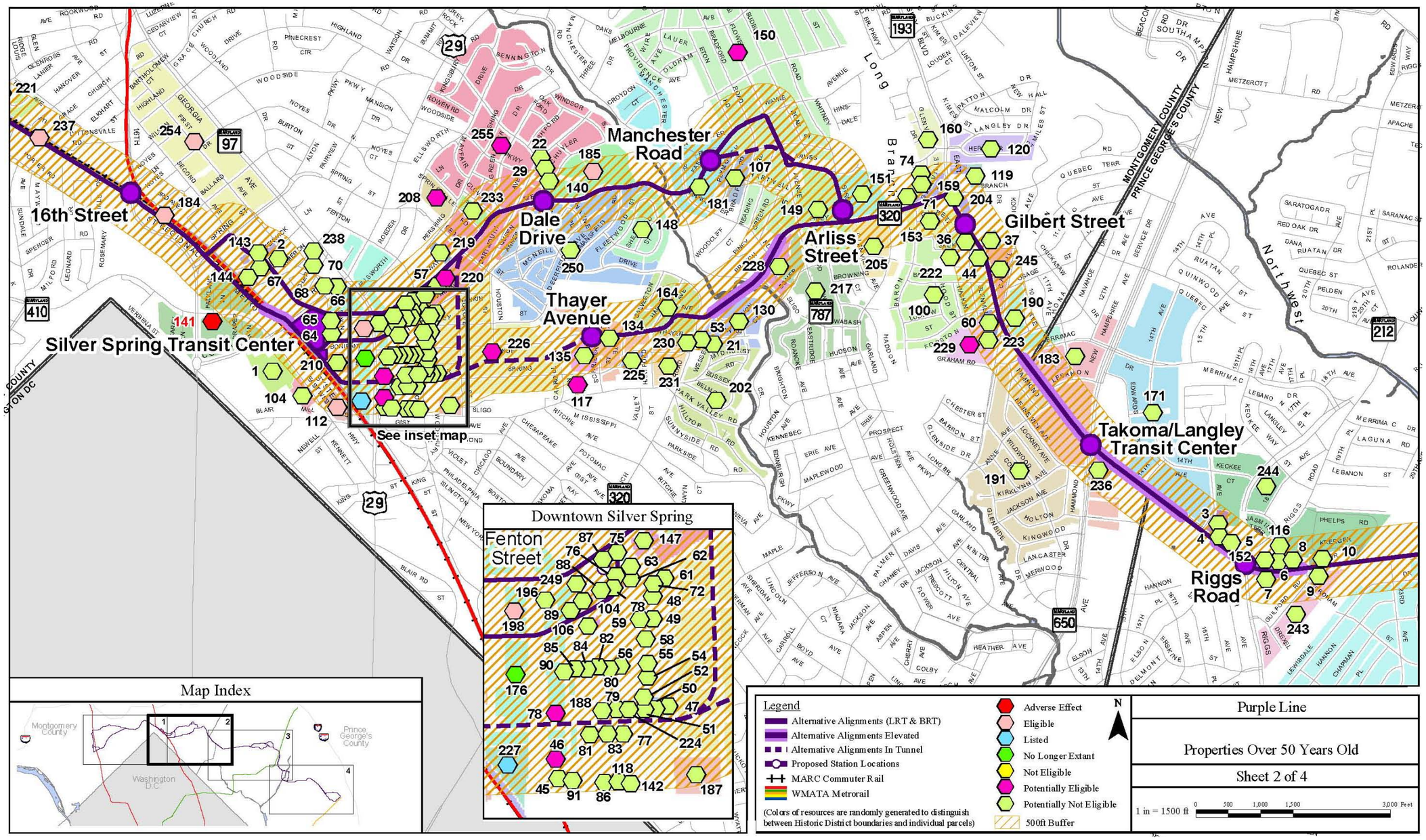


Figure 4.5-1: Properties More than Fifty Years Old (continued)

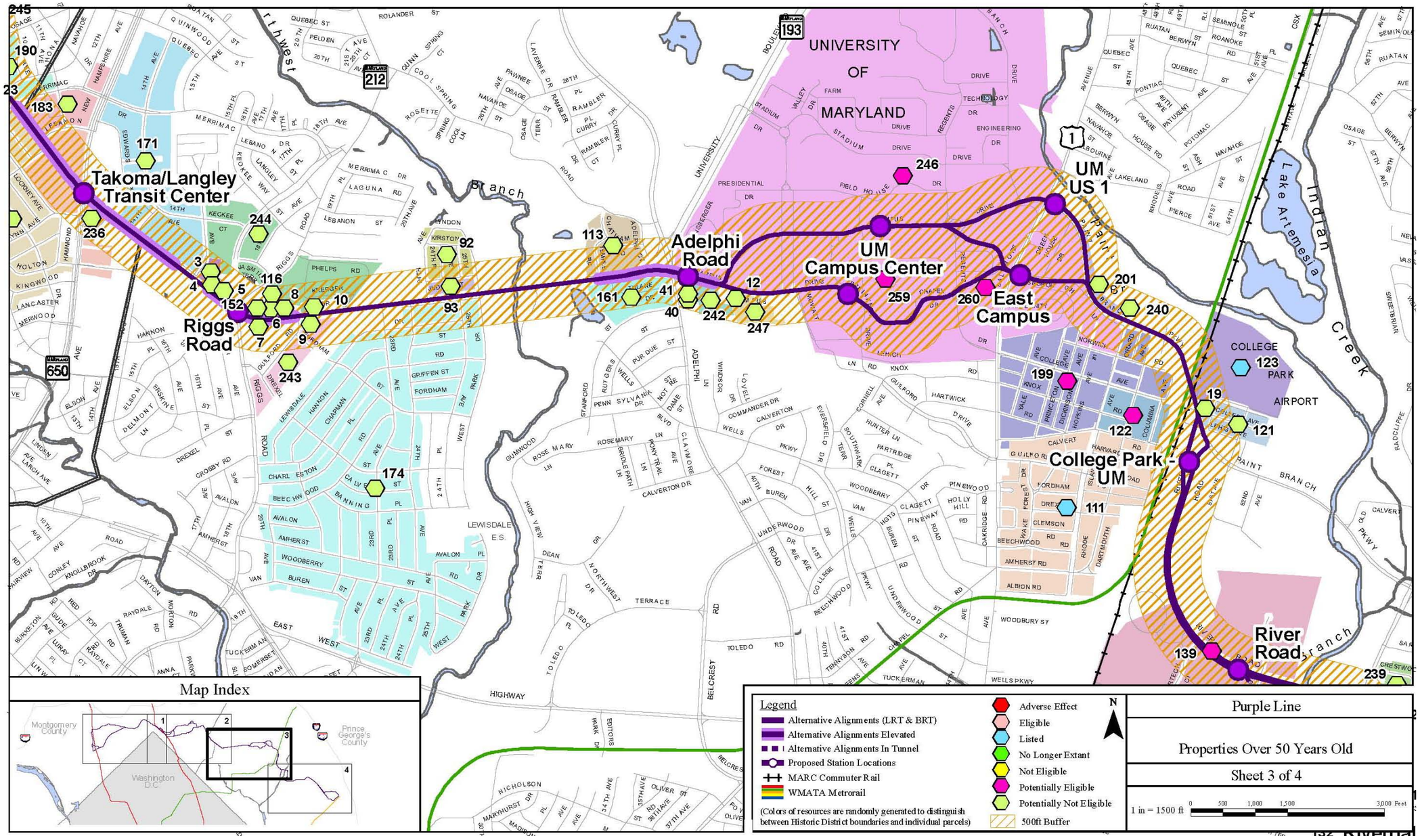


Figure 4.5-1: Properties More than Fifty Years Old (continued)

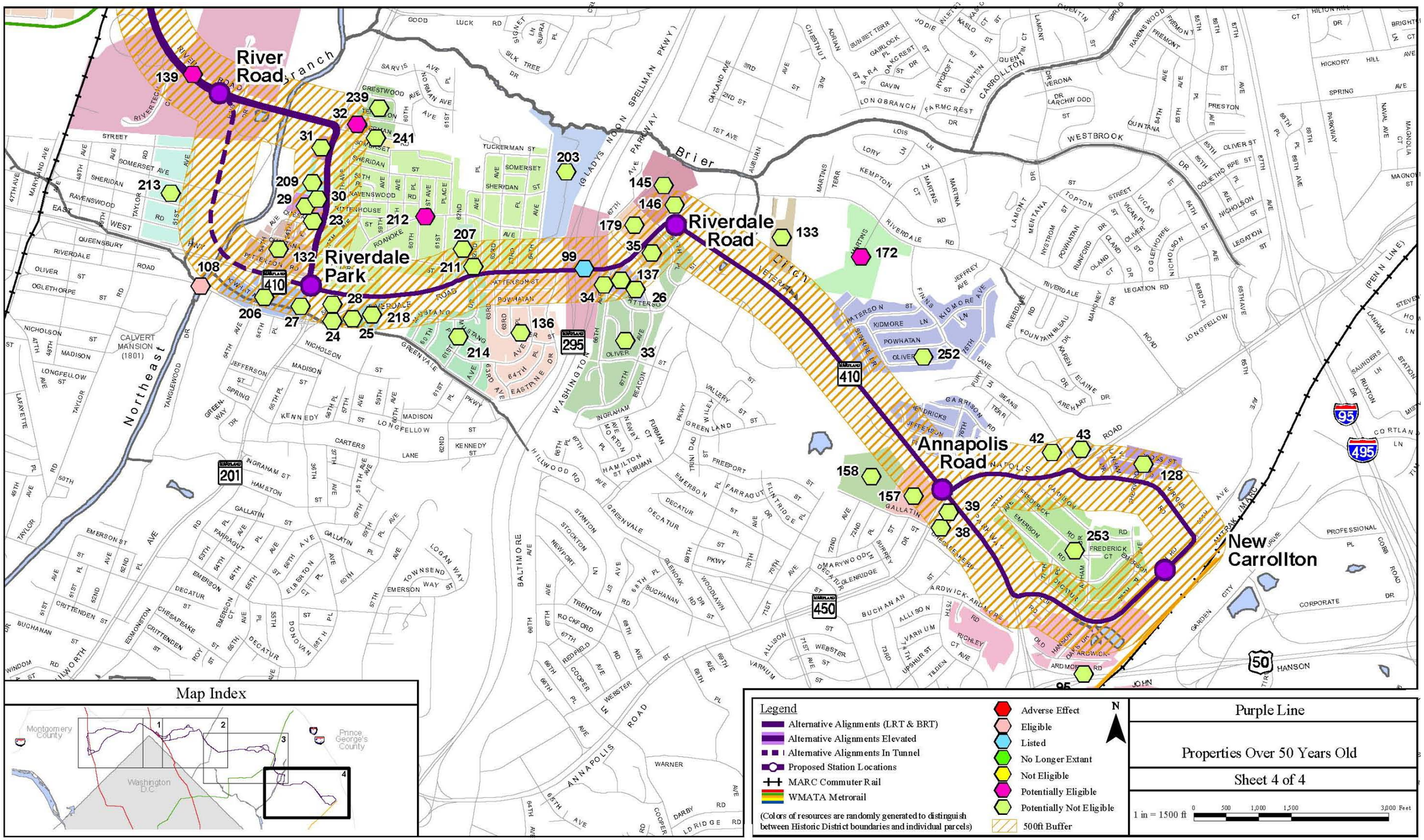


Table 4.5-2: Archeological Sites within the APE

Site Name	Site Number	Resource	Eligibility
Taylor Site	18MO243	Late Archaic-Woodland Short-Term Resource Procurement Camps (Multiple Occupations)	Eligible (6/28/85)
Clean Drinking Water Manor	18MO30	Nineteenth-Century Plantation	Not Determined
Sligo Cabin	18MO356	Prehistoric, Late Nineteenth, Early Twentieth Century	Not Determined
Rock Creek Trestle East	18MO411	Prehistoric Lithic Scatter	Not Eligible (3/12/96)
Columbia Country Club	18MO412	Prehistoric Lithic Scatter	Not Eligible (3/12/96)
Rock Creek Trestle West	18MO413	Prehistoric Lithic Scatter	Not Eligible (3/12/96)
Old Brookville Road Bridge Ruins	18MO414	Late Nineteenth-Early Twentieth Century Bridge Ruins	Not Eligible (3/12/96)
B&O Railroad Connecticut Avenue	18MO415	Late Nineteenth-Early Twentieth Century Railroad Freight Station	Not Eligible (3/12/96)
NNMC 3	18MO646	Prehistoric Unknown	Not Eligible (12/5/06)
NNMC 5	18MO648	Prehistoric Unknown	Not Eligible (12/5/06)
College Park Airport	18PR200	Late Twentieth Century Airport	Listed (NR-436)
Trolley Bridge	18PR257	Late Nineteenth-Twentieth Century Trolley Bridge	Not Determined
ERCO	18PR258	Late Twentieth Century (World War II) Air Field	Not Determined
Fire Site	18PR263	Prehistoric Lithic Scatter	Not Determined
Rhode Island	18PR82	Prehistoric Unknown	Not Eligible (8/25/87)

Table 4.5-3 Areas of Archaeological Potential Identified in Cultural Resource Reconnaissance Survey

Segment	Area Designation	Description of Location
Bethesda-16th Street	Area 1	Southern Boundary of the National Naval Medical Center along Jones Bridge Road
16th Street-Piney Branch Road	Area 2	Area along Pine Branch Road at Long Branch Park/Stream
16th Street-Piney Branch Road	Area 3	Park at the Corner of Sligo Avenue and Pine Branch Road
16th Street-Piney Branch Road	Area 4	Area south of Goodacres Knolls, within Sligo Creek Park and along Sligo Creek
16th Street-Piney Branch Road	Area 5	Area along Piney Branch Road at Long Branch Park
Piney Branch Road-Adelphi Road	Area 6	Limited Open Spaces at the Southern Portions of Langley Park North of University Boulevard
Piney Branch Road-Adelphi Road	Area 7	Limited Open Spaces at the Southern Portions of Langley Park North of University Boulevard
Piney Branch Road-Adelphi Road	Area 8	Areas of Northwest Branch Park along University Boulevard
Adelphi Road-UM Metro	Area 9	Open Space Fronting Buildings along the Eastern Entrance of the UM-CP
Adelphi Road-UM Metro	Area 10	Open Space in the Western Yard Fronting "Fraternity Row" UM-CP
Adelphi Road-UM Metro	Area 11	Open Space West of the B&O Railroad North of College Row
UM Metro-Riverdale Road	Area 12	Open Space of Indian Creek Park/Calvert Road/Paint Branch Parkway
UM Metro-Riverdale Road	Area 13	Open Space of Indian Creek Park/Riverdale Community Park along River Road
UM Metro-Riverdale Road	Area 14	Areas of Undeveloped Space within the Residential Neighborhood of Riverdale Heights, South of Riverdale Hills School
Riverdale Road-New Carrollton	Area 15	Open Space in Conjunction with Auburn Manor near Stream
Riverdale Road-New Carrollton	Area 16	Limited Undisturbed Areas within Glenridge Park along Veterans Parkway
Riverdale Road-New Carrollton	Area 17	Limited Undisturbed Areas along Riverdale Road
Riverdale Road-New Carrollton	Area 18	Limited Undisturbed Areas within Glenridge Park along Veterans Parkway
Riverdale Road-New Carrollton	Area 19	Limited Undisturbed Areas within Glenridge Park along Veterans Parkway
Riverdale Road-New Carrollton	Area 20	Open Spaces along North Side of Veterans Parkway around the Intersection of Ellin Road
Riverdale Road-New Carrollton	Area 21	Wooded Areas of Buffering between Riverdale Road and the Residences of "Lanham Woods"

previous survey a systematic testing grid was established on the site, and shovel test pits were excavated within the area. The site was likely disturbed by construction of a runway, but the extent of that disturbance is unknown to date. When a Locally Preferred Alternative is selected, a Phase I investigation study may be needed on the Fire Site to determine site boundaries and limits of disturbance.

Sligo Cabin Site (18MO356)

The Sligo Cabin Site was identified during the construction of a recreational facility at Sligo Creek Park during a non-systematic survey. This survey was completed by the Maryland-National Capital Park and Planning Commission (M-NCPPC) and the site was identified by James D. Sorenson via pedestrian reconnaissance in 1991. Non-diagnostic prehistoric artifacts and late nineteenth to early twentieth century artifacts were recovered during the walk over. Portions of this site were destroyed with grading and construction activities.

Areas of Archaeological Potential

The *2005 Phase Ia Bi-County Transitway Cultural Resource Reconnaissance Survey* of the Purple Line corridor identified 21 areas of prehistoric and historic archaeological potential within the project area (Table 4.5-3).

Future Archaeological and Historic Evaluations

The current inventory presents previously identified archaeological sites and historic properties included in the MHT – GIS database (and verified by other sources). This level of data collection is sufficient for preliminary evaluation; a comprehensive survey effort for the eastern section of the alignment (Silver Spring to New Carrollton) will be completed should a Build alternative be selected as the Locally Preferred Alternative.

Historic Districts

When completing National Register eligibility determinations, built resources can be evaluated either individually or in groups that together form districts. Typical types of districts include residential neighborhoods, college campuses, and governmental or institutional complexes. In order to evaluate groups of buildings as districts, the buildings should have a concentration or associations that unite them visually or historically. A district can comprise a wide variety of resources but should convey the sense of a cohesive and interrelated environment. Resources that just happen to be near each other but do not relate to each other through use, building type, or period of development may not form a district because of proximity only. When districts are evaluated and determined to be eligible for listing in the National Register, designations of contributing or noncontributing are assigned to each resource. This process is completed to distinguish infill construction or buildings that have been substantially altered from those that retain historic and architectural integrity.

In some cases, individual buildings that are within districts, but are historically or architecturally noteworthy, may be evaluated independently. This process can be completed for two reasons. First, if the Maryland Historical Trust has previously identified but not evaluated an individual building, it must be independently evaluated for eligibility even if it is considered to be a contributing resource to an eligible historic district. Second, in some cases, a district may not be eligible for listing, yet one or more individual resources within the evaluated district boundaries may be independently eligible. This individual evaluation process allows those buildings to be accurately assessed and not overlooked in instances where the district within which the building is located is not eligible.

The archeological sites and the previously identified historic properties have not yet had formal Determinations of Eligibility. These evaluations will be required for all properties within the APE of the Locally Preferred Alternative, once selected.

4.5.5. Parklands

Survey Methodology

During initial field investigations for cultural resources the presence of publicly-owned parks within the APE was documented. However, many of these parks would not be affected by the Purple Line alternatives and do not contain historic buildings or significant designed landscapes. Future research will be conducted to determine if the parks may be eligible for the National Register for historic associations. Some parks may not be individually eligible, but may be contributing elements to historic districts or potential historic districts. Generally, these parks were treated as resources that are potentially eligible for the National Register as contributing resources. Intensive survey and documentation will be undertaken when a Locally Preferred Alternative is selected, and MHT concurrence will be sought on eligibility and effect at that time.

Survey Results for Parklands

The APE contains 24 parks. Of these, five parks have been identified as potentially eligible for the National Register and one, the College Park Airport, is listed. It is anticipated that the Purple Line would have no adverse effect on the College Park Airport.

The five potentially eligible parks are:

- Rock Creek Park Stream Valley Unit 2
- North Chevy Chase Park.
- Sligo Cabin Neighborhood Park,
- Sligo Creek Stream Valley Unit 1
- Sligo Creek Stream Valley Unit 2

It is anticipated that the Purple Line would have no adverse effects on Rock Creek and North Chevy Chase Parks. Originally, a high trestle that extended across Rock Creek supported this section of the Georgetown Branch railroad. The Rock Creek Trestle was previously determined to be not eligible for the National Register by MHT. Therefore, it is anticipated that reintroducing a transitway alignment at a lower elevation and at a lower profile than the original Rock Creek Trestle will have no adverse effects to the Rock Creek Park. Additionally, the Rock Creek Trestle East and Rock Creek Trestle West archeological sites were previously determined not eligible for the National Register by MHT, so there are no anticipated adverse effects for archeology.

It is anticipated that the Purple Line could adversely affect Sligo Cabin Neighborhood Park and the two units of Sligo Creek Stream Valley Park because they are located directly along proposed alignments and are within the APE. The alternatives on Wayne Avenue could adversely impact Sligo Cabin Neighborhood Park, and Sligo Creek Stream Valley Unit 2. The Silver Spring/Thayer design option would adversely impact Sligo Creek Stream Valley Unit 1 through direct property acquisitions. The LRT alternative of this design option would require elevated tracks just west of Piney Branch Road. These elevated tracks would impact the viewshed on Sligo Creek Stream Valley Unit 1 to the south of the tracks and Unit 2 to the north of the tracks.

Station Impacts

Twenty-two potential station locations have been identified. The potential direct effects from station locations have been taken into account and have been included in the 500-foot APE buffer for standing structures on either side of the alignment. The overall design and aesthetics of bus shelters located adjacent to historic districts and historic resources will be sensitive to the architectural context of these resources.

4.5.6. Indirect and Cumulative Effects

The indirect and cumulative effects on cultural resources are a function of local and municipal preservation planning procedures and regulations. These are addressed in *Section 4.18 Indirect and Cumulative Effects Analysis*.

4.5.7. Conclusion

The Purple Line could adversely impact up to 11 eligible standing structure resources, two archaeological sites, and three eligible parklands. When a Locally Preferred Alternative is selected, a detailed analysis of impacts on cultural resources will be conducted. Avoidance and minimization will be considered wherever feasible. However, if adverse effects occur, a mitigation plan will be developed by the MTA in coordination with the MHT and other consulting parties as appropriate.

4.6. Visual Quality

4.6.1. Existing Visual Quality

The visual setting of the Purple Line is that of urban and suburban environments. This section discusses the viewers, viewsheds, character of viewsheds and potential effects related to the Purple Line.

The corridor has been analyzed for visually sensitive areas. Visually sensitive areas are defined as those where viewers are likely to notice changes within the viewshed. In general, areas of high visual sensitivity within the corridor include the following:

Parks, Trails, and Natural Areas – Development within or near these areas is generally more prone to be noticed than development in more urbanized environments.

Historic Districts – Development within historic districts may result in effects if it were to obstruct or obscure views of historic structures, or include new design elements out of context with the style, scale, or massing of the surroundings.

Design Sensitive Areas – Development in design sensitive areas could result in effects if it were to create disparities with the existing design theme, scale, or proportion within the area.

It is important to note that the Purple Line has the potential to enhance existing areas of low visual quality within the corridor. Enhancements may result indirectly from the implementation of the project's high quality design structures and landscaping in areas of low visual quality. Direct enhancements could result from the improvements made to low visual quality areas as part of the construction of the project (i.e., clearing derelict structures, debris, or overgrown vegetation).

The Purple Line would traverse areas that include residential, commercial, park, light industrial, institutional and office land uses. The density of these uses varies widely within the corridor.

Viewers

The viewers that are present within the corridor include the following:

- *Interim Georgetown Branch Trail Users* – trail users would be sensitive to the view of the transitway for the duration of their trail use.
- *Residents* – Residents living within visual range of the alignment would be sensitive to visual changes due to their fixed locations and viewpoints.
- *Pedestrians, Park Users, and Bicyclists* – These individuals would be sensitive to visual changes for the duration of their use of park, pedestrian and bicycle facilities due to the proximity or juxtaposition of the Purple Line to these areas.
- *On-Roadway Travelers* – On-roadway travelers would be sensitive to visual changes, but somewhat less so than those discussed above due to their being in motion and therefore transiently observing the views.

Viewsheds

Bethesda/Chevy Chase Landscape Unit

Bethesda – Bethesda is a mature inner ring suburb of Washington, DC that includes a central business district (CBD) with high-rise development. Surrounding the CBD and extending east to the Silver Spring area are older residential areas that were originally developed as streetcar suburbs of Washington DC. These neighborhoods contain a mix of residential types, but for the most part are predominately single family residences. Streets within this area are lined with mature trees that contribute to the mature residential nature of these neighborhoods. This area is considered to have a high degree of visual sensitivity.

Georgetown Branch Right-of-Way – The Georgetown Branch right-of-way contains a narrow band of mature deciduous trees and shrubs and an unpaved trail. Private residences back onto the right-of-way. Properties adjacent to the right-of-way have varying degrees of screening from vegetation, and in some cases trees provide a canopy over the trail. Broad vistas are present where the right-of-way extends through the Columbia Country Club golf course.

Interim Georgetown Branch Trail

Topographic changes between the trail and the adjacent land uses provide screening along some portions of the right-of-way. In general, trail users are the most prevalent viewers within this area. The second most prevalent are the residents on either side of the trail, and viewers at Columbia Country Club. This area is considered to have a high degree of visual sensitivity.

Rock Creek Park – The Purple Line would cross Rock Creek Park on a bridge with an adjacent but lower bridge for the Capital Crescent Trail. The higher bridge would be developed in the place of a former freight train bridge. The lower bridge would replace the existing bridge that currently supports the Interim Georgetown Branch Trail. The viewshed of Rock Creek Park includes views of a deep valley, paved trails, and a creek. The valley is wooded with open grassy areas along the creek. This area is considered to have a high degree of visual sensitivity.

Trestle Bridge over Rock Creek

Woodmont Avenue – The Low Investment BRT Alternative would travel along Woodmont Avenue in Bethesda. Woodmont Avenue is a busy four-lane roadway, flanked by dense high-rise urban development. The high-rise development becomes less dense as one travels north. Given the heavy traffic on Woodmont Avenue and density of urban development, this area is considered to have a low degree of visual sensitivity.

Woodmont Avenue

Jones Bridge Road – Jones Bridge Road is bordered by single-family residences and several large institutions with grounds containing mature trees. The roadway ranges in width from two to five lanes and is flanked by sidewalks with mature deciduous and evergreen street trees. Jones Bridge Road is currently used by two bus routes and has high levels of traffic. The presence of the trees, the landscaped grounds of the institutions, and the residential character offset the negative effects of the high levels of traffic. Given this, this area is considered to have a moderate degree of visual sensitivity.

Jones Bridge Road, West of Jones Mill Road

Silver Spring Landscape Unit

CSX Rail Right-of-Way – A portion of the proposed project would run along the south side of an existing CSX freight railroad right-of-way. Due to this area being actively used by freight, commuter, and regional passenger rail, it is considered to have a low degree of visual sensitivity.

Downtown Silver Spring – Downtown Silver Spring is a modern urban environment, with commercial and residential uses mixed within and a number of medium- and high-rise structures. Wide streets and large amounts of traffic characterize this area. Given this, this area is considered to have a low degree of visual sensitivity.

Wayne Avenue – Wayne Avenue, comprised primarily of residential uses, is an arterial roadway that carries traffic between downtown Silver Spring and points east. The roadway is served by four bus routes. Wayne Avenue is considered to have a moderate to high degree of visual sensitivity due to the residences and the mature trees in this location.

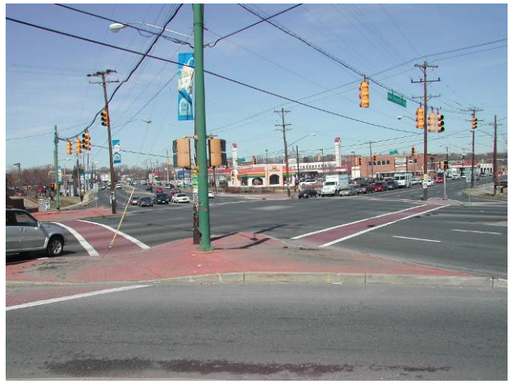
Wayne Avenue

Thayer Avenue – Thayer Avenue is a narrow residential street that is currently used by one bus route and passenger vehicles. It contains single-family residences, several multi-family residential complexes, and is lined with mature trees that create a full canopy over the roadway. Given the primarily residential nature and high quality urban vegetation, Thayer Avenue is considered to have a high degree of visual sensitivity.

University Boulevard Landscape Unit

Piney Branch Road – Piney Branch Road between Flower Avenue and University Boulevard is a wide arterial roadway that is flanked by aging strip-type commercial uses and garden apartments. Street trees are intermittently present along the roadway, and the road crosses Long Branch Stream Valley Park. The intersection of University Boulevard and Piney Branch Road has multiple through-lanes, sidewalks, large amounts of traffic and commercial uses on each corner. In some locations along Piney Branch Road, parking lots parallel to the roadway provide access to the apartments. Given the large amounts of traffic, aging commercial and multi-family residences, this area is considered to have a medium to low degree of visual sensitivity.

University Boulevard and New Hampshire Avenue



University Boulevard – University Boulevard is a heavily traveled arterial that ranges from four to six lanes wide with sidewalks. In some locations parallel service roads provide access to the residential buildings. The existing road crosses Northwest Branch Stream Valley Park just west of Adelphi Road. University Boulevard is lined with a mix of older garden apartments and older auto-oriented strip commercial development. The wide roadway, heavy levels of traffic, lack of landscaping, and the quantity of signage and utilities make this an area of low visual sensitivity.

University Boulevard and Anne Avenue

University of Maryland/College Park Landscape Unit

Campus Drive – The University of Maryland campus includes brick colonial revival style structures ranging from two to five stories. Expansive parking lots and open space dominate the western side of campus. Campus Drive is the central transportation corridor of the campus which conveys cars, service vehicles, and transit vehicles through the campus. The Campus Drive area of the campus is considered to have a medium degree of visual sensitivity.

Campus Drive

Preinkert Drive to Regents Drive – This portion of the corridor passing between LeFrak Hall and the south Dining Hall, by Morrill Quad and the Chapel is a quiet area of campus. Morrill Quad is the oldest quad on campus and contains a number of large mature trees. Due to the matures trees, the historic buildings, and the fact that today there are only pedestrian walkways for much of this segment, this segment is considered to be of high visual sensitivity.

The "M" Traffic Circle

Eastern Portion of Campus – On the eastern portion of the campus large grassy areas (intramural playing fields and open lawns) create wide vistas. The University Master Plan proposes redevelopment of most of the open space and parking lots on the western side of the campus, but proposes to maintain the eastern campus in its current condition. This western side of campus, because of the existing parking lots and the proposed development is an area of low visual sensitivity, the eastern side, with the expansive open spaces is an area of high visual sensitivity.

Intramural Playing Fields

East Campus – The proposed East Campus development (east of US 1) is currently in the planning stage, and is being designed to incorporate the Purple Line as part of its design (a mixed-use development). Given this ability to absorb the proposed project within the campus' designs, this area is considered to have a low degree of visual sensitivity.

Paint Branch Parkway – Paint Branch Parkway is a four-lane arterial roadway that is bordered by open space, institutional uses and light industrial uses. The incorporation of the project would be compatible with the existing character of this area due to the uses along the roadway, thus this area is considered to have low degree of visual sensitivity.

River Road – Many of the properties along River Road are currently under development as part of the University of Maryland's M Square Research Park (an office park). River Road is a wide four-lane roadway with sidewalks. The eastern end of River Road crosses Anacostia Stream Valley Park. Due to the office park use of this area, it is considered to have a low degree of visual sensitivity.

Riverdale Park Landscape Unit

Kenilworth Avenue and East West Highway – Kenilworth Avenue and East West Highway are wide, four- to six-lane major arterials with a mix of auto-oriented commercial uses and older residential developments. The roadways are lined with sidewalks, utilities poles and wires, and commercial signage. Due to heavy traffic volumes, aging residential uses and existing visual clutter, this area is considered to have a low degree of visual sensitivity.

Kenilworth Avenue at East West Highway

New Carrollton Landscape Unit

Veterans Parkway – Veterans Parkway is a wide, four-lane arterial roadway with a grass center median and no sidewalks. Residences flanking both sides of the roadway, are accessed by other streets, are set back from the parkway, and are buffered by a mix of deciduous trees and shrubs. The posted speed limit is 45 miles per hour, the highest speed limit of the roadways being evaluated in this analysis. Due to the width of the roadway and the set back of residential properties, this area is considered to have low degree of visual sensitivity.

Veterans Parkway

Ellin Road – Ellin Road is a four-lane roadway bordered by deciduous trees and bushes that screen the residential properties that back onto the road. By the New Carrollton Metro Station there are several large office buildings. Given the screening of the residential neighborhoods and the prevalence of office uses by the station this area is considered to have a low degree of visual sensitivity.

Annapolis Road – Annapolis Road is a six-lane major arterial that carries heavy volumes of passenger cars, buses, and trucks. It is flanked by strip-type commercial uses. A number of signs, poles, and utilities obscure views along this roadway. Given the visually cluttered nature of this area, it is considered to have a low degree of visual sensitivity.

Harkins Road – Harkins Road begins on the western side of Ellin Road and extends to the west, terminating at Annapolis Road. This roadway has roughly the same visual characteristics as that of Ellin Road, thus it is considered to have a low degree of visual sensitivity.

System-Wide Infrastructure

No specific design decisions (i.e., construction materials, structures, shelters, colors, brand of vehicles, etc.) have been made as of yet for the Purple Line. Hence, the following potential effects have been determined by using design attributes typically present in BRT and LRT projects. These attributes coupled with the knowledge of the alignments, was used to determine effects within the corridor. Although the specific design is yet to be determined, it is known that each of the proposed alternatives will have, to some degree, one or more of the following transit system components.

Transitways – Transitways for buses (busways) are paved similar to roadways. Placed in existing roadways they have no visual impact. Placed outside or adjacent to existing roadways they would appear like road widening or an additional roadway. For light rail in existing roadways the transitway would be an embedded track. Light rail trackways in new right-of-ways could be embedded track in asphalt or concrete, ballasted track, or grass track. Guideways or trackways are approximately twelve feet wide per direction of travel. Although busways or embedded track have little to no visual impact in themselves, they are often delineated through different paving materials or striping to keep motor vehicles from mistakenly driving upon them. Physical barriers such as low mountable curbs could also be used. Such treatments can be attractive or not, depending on design and the surrounding environment.

Tunnels – MTA is studying tunnels in five locations within the corridor. While the visual effects to the land uses above tunnels are generally minimal and limited to intrusions of ventilation and elevator shafts, stairways, and/or escalators, the vehicular entrances to tunnels may have substantial visual effects, depending on their nearby land uses. Portals and their related retaining walls can be up to 400 feet long before the transitway enters underground. Where tunnels would be constructed by cut-and-cover methods there would be substantial temporary visual impacts during construction.

Stations – Station platforms for both BRT and LRT would be approximately 200 feet long and 10 to 15 feet wide, depending on the anticipated ridership at a particular station. Station platforms could be incorporated into existing sidewalks. The vehicles would have low floors that would require station platforms that are typically 14 inches higher than the street. Stations could include a shelter, fare collection equipment, signage, lighting, and landscaping. The stations are intended to be more visible and have a more pronounced visual presence than current bus shelters in the corridor, but would be compatible with surrounding neighborhood character and local government standards. As described above, stations along underground alignments may have some infrastructure shown at the surface.

Vehicles – The BRT Alternatives would likely use articulated buses that would be approximately 60 feet long. LRT vehicles would be approximately 8.5 feet wide and 60 to 90 feet long. The LRT vehicles could operate in two- to three-car trains approximately 180 feet long. To minimize the impact of the vehicles and create a system more appropriate to the character of the corridor, and the streetcar style operations, the MTA has determined that the LRT vehicles will have low-floors and will be relatively narrow.

Structures – Overpasses, bridges, and retaining walls will exhibit the character typically represented by BRT and LRT projects. As indicated above, the project will be designed to be compatible with the character of the surrounding neighborhood and in accordance with local government standards.

Ancillary Equipment – LRT would be powered by an overhead electrical system. This system would include overhead wires used to power the vehicles, poles to support the wires, and traction power substations. To minimize the visual presence of the overhead wires, the MTA has proposed that the Purple Line use trolley wire instead of a catenary system, if the LRT is the selected mode. Trolley wire is a single wire system, as opposed to the larger, more elaborate catenary system needed for higher speed operations. The trolley wire system is suspended by poles 17 to 22 feet above the street over each track. The poles would be located either between the two tracks, or on either side of the roadway, depending on the configuration of the alternative per location. The poles are typically located every 100 to 120 feet. Where curves are sharp, a more dense arrangement of poles and support wires are generally needed. The poles supporting the overhead wires can be integrated with other utility, signage, or lighting poles to reduce the visual impact of the LRT Alternatives.

The traction power substations required by the LRT would be located approximately every 1.25 miles along the alignment. These substations are approximately 10 feet by 40 feet, placed near, but not necessarily directly adjacent to, the transitway. This flexibility allows them to be located so that they minimize their visual effects by being screened with structures, fencing, or landscaping. They can also be located in existing buildings or underground, as is often done in urban areas. The exact location of these substations would be determined during the preliminary engineering phase of the project, should LRT be the selected mode

Maintenance and Storage Facilities – These facilities include storage areas and repair shops for vehicles in the fleet. Two maintenance facilities are planned for the BRT and LRT Alternatives. These facilities would include a building in which the vehicles would be inspected and maintained, a vehicle washing facility, storage areas for vehicles (parking for buses and tracks for LRT), and employee parking.

Traction Power Substations in Independent Structures

Traction Power Substation Screened by Brick Walls

4.6.2. Potential Effects

TSM Alternative

The TSM alternative would include one new express bus service but would eliminate two existing bus routes. The remaining bus routes would not have additional service. The corridor's existing visual character would generally remain as it is today, subject to current development trends and increased traffic congestion.

Build Alternatives

The incorporation of the Purple Line on existing roads is considered compatible with the original character of the roadways and communities along the alignment. Most of the roadways are arterials and already have a number of frequently operating bus routes on them. BRT therefore, would likely have little to no visual effects.

LRT and its required infrastructure (rails, wires, and traction power substations) would have a greater effect, but would still be suitable to the corridor.

The greatest visual effect of the Purple Line Build alternatives would be along the Georgetown Branch right-of-way. All of the alternatives would use at least some portion of the right-of-way. For instance, the Low Investment BRT would use approximately one mile of the 3.3-mile right-of-way, while all the other alternatives would use the whole length. The vegetation in the right-or-way would be cleared for any new LRT or BRT alignment, and while new landscaping would be included in the construction, the mature trees would not be replaced. The clearing of vegetation for construction would reduce screening of the corridor from neighboring land uses. This would potentially cause substantial visual effects for the adjacent land uses and trail users.

Construction of the transitway and a permanent trail would incorporate new landscaping, but of a different nature than that which currently exists.

The MTA has made a number of design modifications to minimize the related effects in consideration of this visually sensitive area. These modifications include moving the trail to the north side of the alignment between Pearl Street and just west of Jones Mill Road. Following the existing topography, which is higher on the north side, allows for a natural placement of the transitway three to four feet below the level of the trail, creating a more pleasant experience for the trail user and minimizing the required retaining walls. A goal of providing a 10-foot buffer of landscaping between the trail and the transitway has been added to further improve the experience of trail users. The periodic (as often as once every three minutes during peak periods) but brief passing of LRT or BRT vehicles would be a substantial impact for trail users. The MTA is also considering the use of grass tracks where possible to maintain a more natural character for the right-of-way.

Grass Tracks

All of the Build alternatives cross Rock Creek Park within the Georgetown Branch right-of-way. The Interim Georgetown Branch Trail currently crosses Rock Creek Park on a trestle bridge. The construction of the Purple Line in this area would entail the replacement of this bridge for the transitway, and the construction of an adjacent, slightly lower, pedestrian bridge for the trail. Due to the reduction in elevation, the new pedestrian bridge would provide less dramatic views for trail users. The two Purple Line bridges would be a substantial visual impact.

Twenty-five years ago freight trains used the Georgetown Branch right-of-way. Since then the right-of-way has been unused by freight trains. The construction of the Purple Line in this area would introduce the new visual elements of two new bridges and the periodic (as often as once every three minutes during peak periods) but brief passing of LRT or BRT vehicles. Rock Creek Park Trail users would also be affected by the Purple Line in this area of high sensitivity.

The alternatives cross four other large linear parks on existing roadways, Sligo Creek Park, Long Branch Park, Northwest Branch Park, and Anacostia River Park. The roadways on which the Purple Line would operate as it crosses Long Branch, Northwest Branch, and Anacostia River Parks are all four lanes wide, heavily traveled, and are currently used by buses, so the addition of LRT or BRT in these areas would not represent a meaningful change in the viewshed.

The crossing of Sligo Creek Parkway on Wayne Avenue would require widening of the existing bridge, which would represent a visual effect.

If the Silver Spring / Thayer Avenue design option were selected, Thayer Avenue would undergo a considerable change in visual character as it is currently a narrow, quiet, residential street with a canopy of mature trees. Likewise, the aerial structure on a portion of Piney Branch Road required for the LRT for the same design option would result in substantial visual changes both for local residents and users of the Sligo Creek Trail.

The Purple Line would be on a new transitway along the back of Rosemary Hills Elementary School, single-family homes, garden apartments and, closer to downtown Silver Spring, high-rise apartment buildings. This transitway would lie between the CSX rail right-of-way and these properties. While the residential viewers and the school users would continue to see a transportation corridor, the Purple Line would be far closer, and at the same level as the buildings,

having a substantial visual impact in that neighborhood.

Through the University of Maryland the Preinkert/Chapel Drive design option has substantial visual effects because the transitway would be on new right-of-way and on roadways that are not currently heavily used. The area of the University through which this option runs is largely pedestrian, without the character of a transportation corridor.

In several locations aerial structures are proposed to cross busy streets. This would result in a visual effect. However, if a context-sensitive design is utilized, this design would not necessarily result in an adverse effect. The aerial structures in these areas would be designed in coordination with local stakeholders to develop a concept that complements the visual character of the area.

In general, the LRT Alternatives could result in visual effects because they would introduce new visual elements into areas with no existing similar elements. However, five of the communities within the corridor (Bethesda, Chevy Chase, Takoma Park, College Park, and Riverdale Park) were served by streetcar lines as late as the 1950s and were developed, in part, because of the introduction of streetcars. One streetcar line extended along Wisconsin Avenue from the Chevy Chase / Bethesda area to Rockville. Another streetcar line extended along Connecticut Avenue and had its turnabout at Chevy Chase Lake, where the former B&O Railroad right-of-way crosses Connecticut Avenue immediately east of the Columbia County Club. Some trolley lines extended along Georgia Avenue and served Takoma Park, while others served College Park and Riverdale. The former presence of these trolley lines demonstrates that, in general, the presence of the LRT and its rails and wires would not be incompatible with the original character of many of these communities nor the modern arterial streets of today.

The Purple Line would include two maintenance and storage facilities. The Lyttonsville facility would be compatible with the surrounding light industrial uses, and the facility is currently being used by the Montgomery County Department of Public Works and Transportation as a maintenance depot and Ride On bus service maintenance and storage facility. The facility location on Veterans Parkway is currently the Glenridge park maintenance facility, and it is surrounded by wooded areas. Because both are either in light industrial areas or are currently screened, these sites are unlikely to have substantial visual effects.

4.6.3. Conclusions

The visual effects of the Purple Line alternatives have been considered in the development of the alternatives. Some alignment options have been eliminated because of their potential high levels of visual impact, while others have been modified to minimize effects.

Although some alignment options having high potential for visual effects have been eliminated or modified, the MTA has not developed specific mitigation measures at this stage of the project. Eliminated alignment options include an aerial structure for the transitway over Colesville Road at Wayne Avenue, and an aerial crossing over the CSX tracks in North Woodside. Decisions on specific mitigation measures would be made in coordination with local stakeholders and jurisdictions should a Build alternative be selected as the Locally Preferred Alternative. Mitigation could include:

High-quality design and construction of the proposed transit facilities will be important mitigation tools for visual quality and aesthetics. The following techniques could be employed for any of the alternatives considered to improve the visual effects of the Purple Line:

- Planting vegetation, street trees, and landscaping in and around the project where appropriate,
- Giving special consideration to the design of alternatives that could result in visual impacts from public parks, open spaces, and historic or cultural resources,
- Designing station and maintenance facility lighting to reduce impacts from glare.
- Using roadway surface treatments;
- Minimizing structural bulk where appropriate,
- Use of existing poles or buildings to support the trolley wires and/or new signage; and
- Designing the facilities to complement or blend with the surrounding communities.

Should a Build alternative be identified as the Locally Preferred Alternative, the MTA would coordinate with the local communities and responsible agencies to create visual design guidelines for the project.

4.7. Air Quality

4.7.1. Affected Environment

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility, damaging property, reducing the productivity or vigor of crops or natural vegetation, or harming human or animal health.

As required by the Clean Air Act (CAA), National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants. These pollutants, known as criteria pollutants, are carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead.

The federal standards are summarized in Table 4.7-1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare, and they account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

For more detail see the *Air Quality Technical Report.*

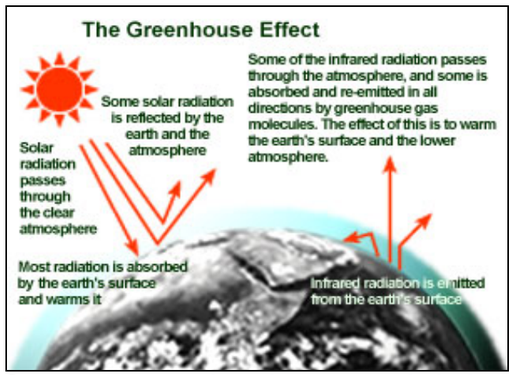
Mobile Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, the U.S. Environmental Protection Agency (EPA) also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human made sources, including on road mobile sources, non road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). The CAA identified 188 air toxics. In 2001 EPA identified a list of 21 Mobile Source Air Toxics (MSAT) and highlighted six of these MSATs as priority MSATs. Since 2001, EPA has conducted an extensive review of the literature to produce a list of the compounds identified in the exhaust or evaporative emissions from on-road and non-road equipment, as well as alternative fuels. This list currently includes approximately 1,000 compounds, many emitted in trace amounts.

Greenhouse Gases

Gases that trap heat in the atmosphere are often referred to as greenhouse gases. Greenhouse gases are necessary to life as we know it because they keep the planet's surface warmer than it otherwise would be. This is referred to as the Greenhouse Effect (Figure 4.7-1). As concentrations of greenhouse gases are increasing, however, the Earth's temperature is increasing. According to National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) data, the Earth's average surface temperature has increased by about 1.2 to 1.4ºF in the last 100 years. Eleven of the last twelve years rank among the twelve warmest years on record (since 1850), with the warmest two years being 1998 and 2005. Most of the warming in recent decades is very likely the result of human activities. Other aspects of the climate are also changing, such as rainfall patterns, snow and ice cover, and sea level.

Figure 4.7-1: The Greenhouse Effect



Source: //www.epa.gov/climatechange/science/index.html

Attainment Status/Regional Air Quality Conformity

Section 107 of the 1977 Clean Air Act Amendment requires that EPA publish a list of all geographic areas in compliance with the NAAQS, as well as those areas not in attainment of the NAAQS. The designation of an area is made on a pollutant-by-pollutant basis. EPA's area designations are shown in Table 4.7-2.

Table 4.7-2: Attainment Classifications and Definitions

Classification	Definition
Attainment	Area is in compliance with the NAAQS.
Unclassified	Area has insufficient data to make a determination and is treated as being in attainment.
Maintenance	Area once classified as nonattainment but has since demonstrated attainment of the NAAQS.
Nonattainment	Area is not in compliance with the NAAQS.

The corridor is classified as a maintenance area for CO, a nonattainment area for $PM_{2.5,}$ and a moderate nonattainment area for O_3. The area must come into attainment for $PM_{2.5}$ and O_3 by April 2010 and June 2010, respectively.

The No Build alternative assumes that no new improvements would be made to the transportation system in the study corridor, other than those that are currently in local and regional transportation plans and that have identified funds for implementation by 2030. Thus it consists of the transit service levels, highway networks, traffic volumes, and forecasted demographics for the horizon year of 2030 that are assumed in the Constrained Long Range Plan (CLRP) of the local metropolitan planning organization (MWCOG, in this case).

The western segment of the Purple Line, the former Purple Line West, Bethesda to Silver Spring, is in the CLRP as a project; the eastern portion, Purple Line East, Silver Spring to New Carrollton, is in the CLRP as a study. Therefore

Table 4.7-1:National Ambient Air Quality Standards

Pollutant	Averaging Period	National and State Standards	
		Primary	Secondary
Carbon Monoxide (CO)	Eight Hours[1]	9 ppm (10 mg/m^3)	No Secondary Standard
	One Hour[1]	35 ppm (40 mg/m^3)	No Secondary Standard
Lead (Pb)	Maximum Quarterly Average	1.5 µg/m^3	Same as Primary Standard
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	0.053 ppm (100 µg/m^3)	Same as Primary Standard
Particulate Matter (PM_{10})	Annual Arithmetic Mean[2]	50 µg/m^3 / Revoked[2]	
	24-Hour[3]	150 µg/m^3	
Fine Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean[4]	15 µg/m^3	Same as Primary Standard
	98th Percentile 24-Hour[5]	65 µg/m^3/ 35 µg/m^3	Same as Primary Standard
Ozone (O_3)	Fourth Highest Eight-Hour Daily Maximum[6]	0.08 ppm	Same as Primary Standard
	Maximum Daily One-hour Average[7] (Applies only in limited areas)	0.12 ppm (235 µg/m^3)	Same as Primary Standard
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	80 µg/m^3 (0.03 ppm)	–
	24 Hours[1]	365 µg/m^3 (0.14 ppm)	–
	Three Hours[1]	–	1,300 ug/m$^{3\ /\ (0.5\ ppm)}$

Source: EPA, National Primary and Secondary Ambient Air Quality Standards (49 CFR 50), October, 2006.

Notes:

1 Not to be exceeded more than once per year.

2 Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM10 standard in 2006 (effective December 17, 2006).

3. Not to be exceeded more than once per year on average over three years.

4. To attain this standard, the three-year average of the weighted annual mean PM2.5 concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

5 To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35µg/m3 (effective December 17, 2006).

6 To attain this standard, the three-year average of the fourth-highest daily maximum eight-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

7 (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤1, as determined by Appendix H of 40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title40/40cfr50_main_02.tpl.

(b) As of June 15, 2005, EPA revoked the one-hour ozone standard in all areas except the 14 eight-hour ozone nonattainment Early Action Compact (EAC) Areas. The project is not located in one of these areas.

Abbreviations: ppm = parts per million, µg/m^3 = micrograms per cubic meter.

only the segment of the Purple Line between Bethesda and Silver Spring is assumed in the regional conformity analysis.

The conformity determination is based on the latest planning assumptions.

Monitored Air Quality

The Air and Radiation Management Administration (ARMA), within the Maryland Department of the Environment (MDE), is responsible for implementing and enforcing regulations to ensure that the air that Maryland citizens breathe is clean and healthful. This mission is accomplished through several methods, including air pollution monitoring. The MWCOG collects and distributes air quality data from monitors located throughout the Washington, DC, Virginia, and Maryland area. Figure 4.7-2 shows the location of the monitors within the Washington metropolitan area relative to the Purple Line. Monitored air quality data within or near the corridor was reviewed. Maximum measured air pollutant concentrations at these monitors are shown in Figure 4.7-3.

Pollutants for Analysis

Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project's impacts; these pollutants include CO, HC, NO_x, O_3, PM_{10}, $PM_{2.5}$, and MSAT.

Regional Analysis

A regional or mesoscale analysis of a project determines a project's overall impact on regional air quality levels. This analysis uses regional Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) within the region with and without the project to determine daily "pollutant burden" levels.

4.7.2. Environmental Consequences

An emission burden analysis based on the corridor's 2030 VMT and VHT was conducted for each of the Build alternatives and compared to the No Build alternative. Emission factors were calculated using EPA's MOBILE6 mobile source emission factor program. All the predicted changes in regional pollutant burden levels from the project are less than 0.05 percent, making them essentially immeasurable. Overall the project's predicted impact on regional pollutant levels range from minor positive to no impact.

Microscale CO Analysis

Microscale air quality modeling was performed using the most recent version of the EPA mobile source emission factor model (MOBILE6.2) and the CAL3QHC (Version 2.0) air quality dispersion model to estimate future No Build (without the proposed project) and future Build (with the proposed project) CO levels at selected locations in the project area.

Seventeen intersections were chosen for analysis (Table 4.7-3 and Figure 4.7-5) and three free-flow sites were chosen based on nearby land use: Interim Georgetown Branch Trail (FF1 on Figure 4.7-5); North Chevy Chase Elementary School (FF2 on Figure 4.7-5); and Rosemary Hills Elementary School (FF3 on Figure 4.7-5).

Maximum one-hour and eight-hour CO levels were predicted at receptor sites along the proposed project for the existing (2006), opening (2015), and design (2030) years. No violations of the NAAQS are predicted under any alternative.

$PM_{2.5}$ Assessment

It has been determined that the project meets all the project-level $PM_{2.5}$ conformity requirements, and that the project will not cause or contribute to a new violation of the $PM_{2.5}$ NAAQS, or increase the frequency or severity of a violation for the following reasons:

Figure 4.7-2: Air Quality Monitoring Locations

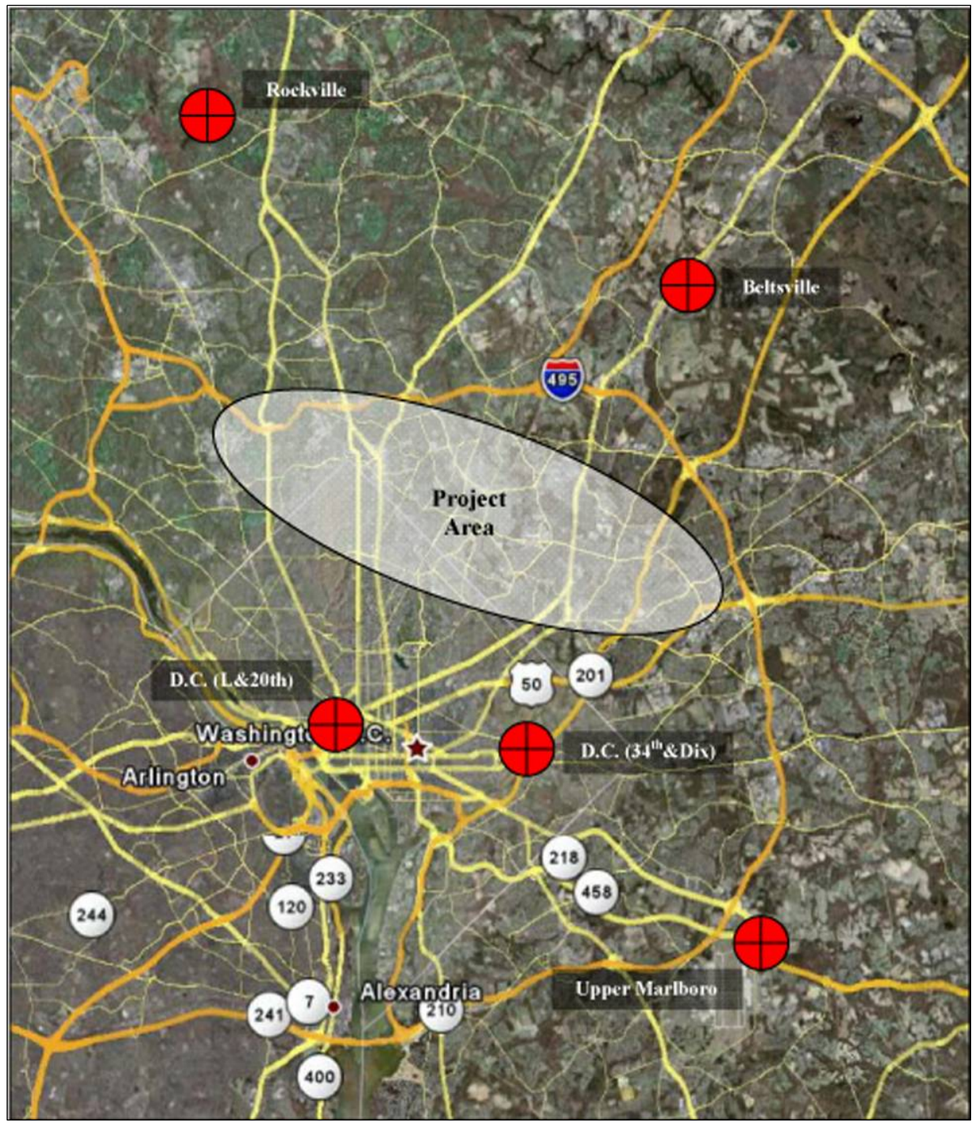
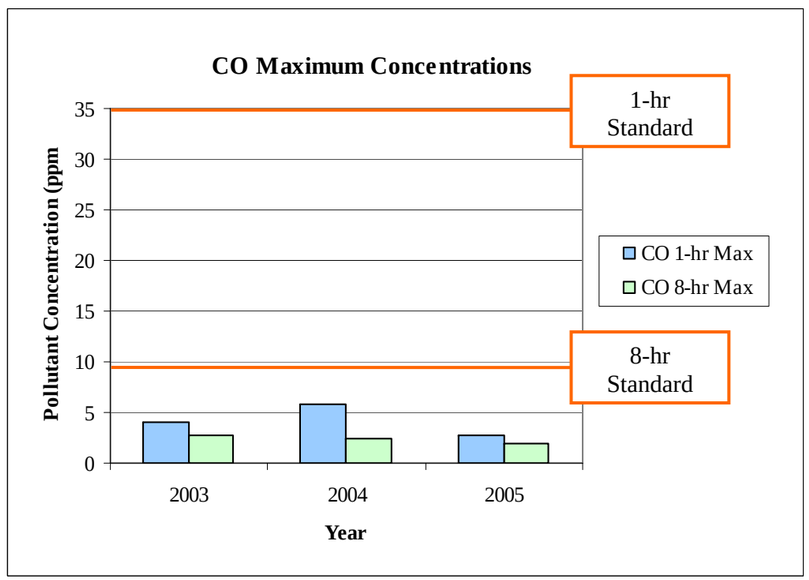
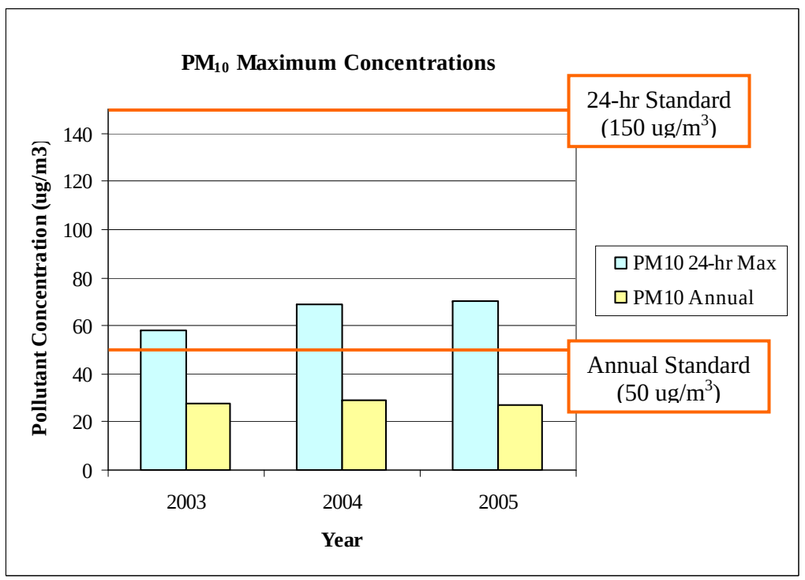
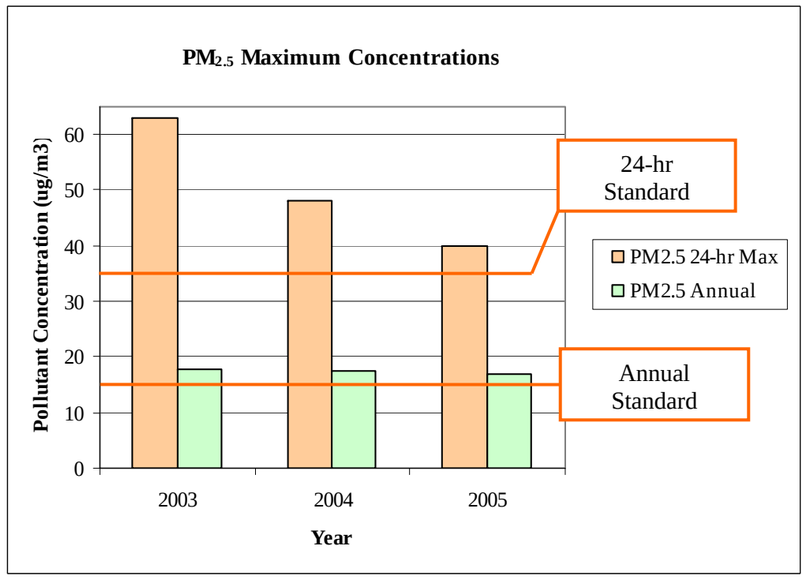
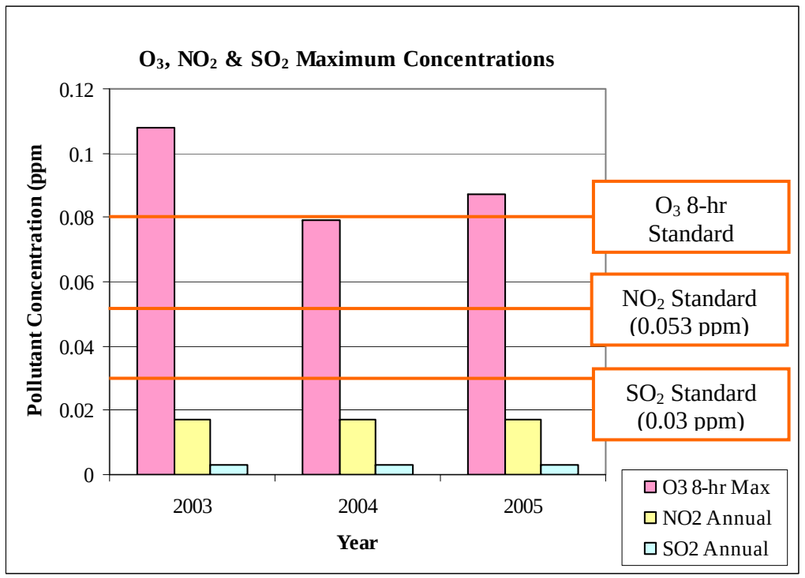


Figure 4.7-3: Maximum Measured Pollutant Concentrations









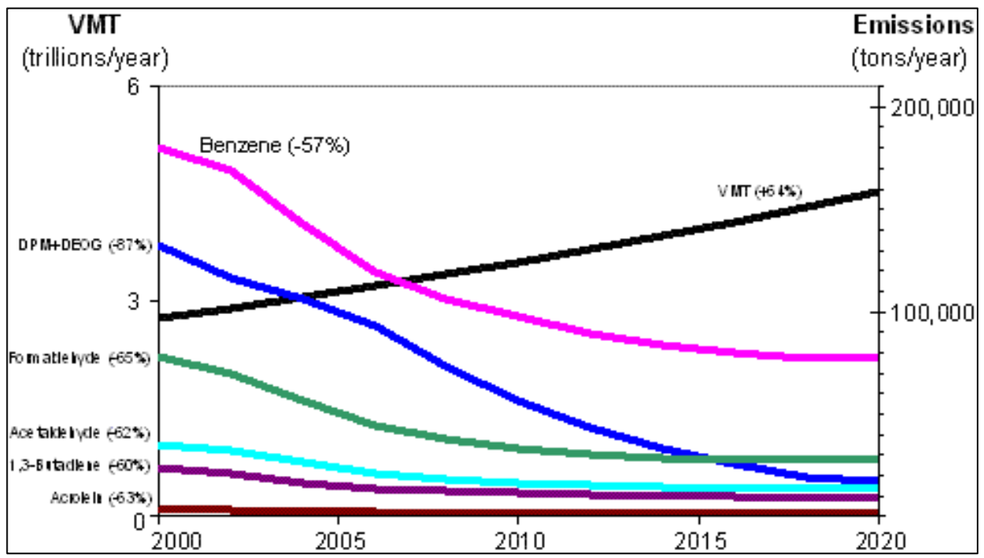
- A monitor with comparable traffic characteristics and roadway influences to the project area in the year of estimated peak emissions is currently monitoring $PM_{2.5}$ concentrations that are below the annual and 24-hour standards.
- Vehicular emissions are expected to be reduced in the project area, as demonstrated by projected reductions in regional emissions, as well as by national projections by EPA reflecting the impacts of national emissions-control programs, of national emissions control programs, such as the 2007 Heavy-Duty Diesel Rule.
- The project proposes to use hybrid buses, which are predicted to have lower $PM_{2.5}$ emission levels than current diesel buses.
- The project is predicted to reduce regional VMT levels as compared to the No Build alternative.

MSAT Assessment

The amount of MSATs emitted would be proportional to the VMT, assuming the vehicle mix does not change. As shown in Figure 4.7-5, predicted regional VMT estimates indicate that all Build alternatives would reduce regional VMT within the 0.02 percent to 0.04 percent range. Project level emissions are presented in Table 4.7-3. These small changes cannot be considered measurable; thus the project is predicted to generally produce no meaningful regional MSAT effects.

The reconfigured travel lanes contemplated as part of the Build alternatives may have the effect of moving some traffic closer to nearby homes, schools, and businesses; therefore, there may be localized areas where ambient concentrations of MSATs could be higher under the Build alternatives than under the No Build alternative. However, the magnitude and duration of these

Figure 4.7-4: Projected MSAT Emissions and Traffic Volumes: 2000 – 2020



Notes: For on-road mobile sources. Emissions factors were generated using MOBILE6.2. MTBE proportion of market for oxygenates is held constant, at 50 percent. Gasoline RVP and oxygenate content are held constant. VMT: Highway Statistics 2000, Table VM-2 for 2000, analysis assumes annual growth rate of 2.5 percent. "DPM + DEOG" is based on MOBILE6.2-generated factors for elemental carbon, organic carbon and SO4 from diesel-powered vehicles, with the particle size cutoff set at 10.0 microns.

potential increases compared to the No Build alternative cannot be accurately quantified because of the inherent deficiencies of current models.

MSAT emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020 (Figure 4.7-4). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures.

However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the corridor are likely to be lower in the future in nearly all cases.

A qualitative analysis of MSAT emissions is provided relative to the various alternatives (Table 4.7-4), and has acknowledged that the Build alternatives may increase exposure to MSAT emissions in certain locations, although the concentrations and duration of exposures are uncertain. Because of this uncertainty, the health effects from these emissions cannot be estimated.

To identify which intersections in the corridor are most congested and would be most affected by the Build alternatives, a screening evaluation was performed. Fifty-eight locations were screened based on changes in intersection volumes, delay, and levels of service (LOS) from the No Build to the Build alternatives. Sites failed the screening evaluation if the LOS decreases below D in one of the Build alternatives as compared to the No Build alternative, or if the delay or volume increase from the No Build to Build scenario along with a LOS below D. Those locations which were anticipated to experience adverse effects were dispersed throughout the corridor and were not disproportionally located in EJ communities. As noted earlier, further information is provided in the *Air Quality Technical Report.*

Table 4.7-3: CO Microscale Analysis Locations

Preliminary Site #	Intersection Description	Neighborhood
1	Woodmont Avenue and Battery Lane	Jones Bridge Road / Woodmont Avenue
2	Jones Bridge Road and Rockville Pike	Jones Bridge Road / Woodmont Avenue
3	Jones Bridge Road and Connecticut Avenue	Jones Bridge Road / Woodmont Avenue
4	Jones Bridge Road and Jones Mill Road	Jones Bridge Road / Woodmont Avenue
5	Second Avenue and Colesville Road	Downtown Silver Spring
6	Wayne Avenue and Cedar Street	East Silver Spring
7	Wayne Avenue and Dale Drive	East Silver Spring
8	Wayne Avenue and Sligo Creek Parkway	East Silver Spring
9	University Boulevard and Piney Branch Road	East Silver Spring
10	University Boulevard and New Hampshire Avenue	University Boulevard
11	Campus Drive and Adelphi Road	University Boulevard
12	Kenilworth Avenue at East West Highway	Riverdale Park
13	East West Highway at Baltimore Washington Parkway Southbound Ramps	Riverdale Park
14	East West Highway at Baltimore Washington Parkway Northbound Ramps	New Carrollton
15	Veterans Parkway at Annapolis Road	New Carrollton

Greenhouse Gas Assessment

CO_2 emission estimates are based on the amount of direct energy required for each alternative. The direct energy values represent the energy required for vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and thermal value of the fuel being used. The direct energy calculations also include the energy required to fuel the BRT alternatives and power the LRT alternatives. CO_2 emission coefficient factors are then applied to the energy estimates to determine the amount of CO_2 generated. For roadway energy a CO_2 emission coefficient of 156.425 lbs CO2 per million BTU and 161.386 per million BTU were used for gasoline fueled vehicles and diesel fueled vehicles, respectively. A coefficient factor of 401.5 lbs CO_2 per million BTU was used for electrical power generation for the LRT. All coefficient factors were obtained from the Department of Energy's, Energy Information Administration.

Figure 4.7-5: Air Quality Analysis Locations

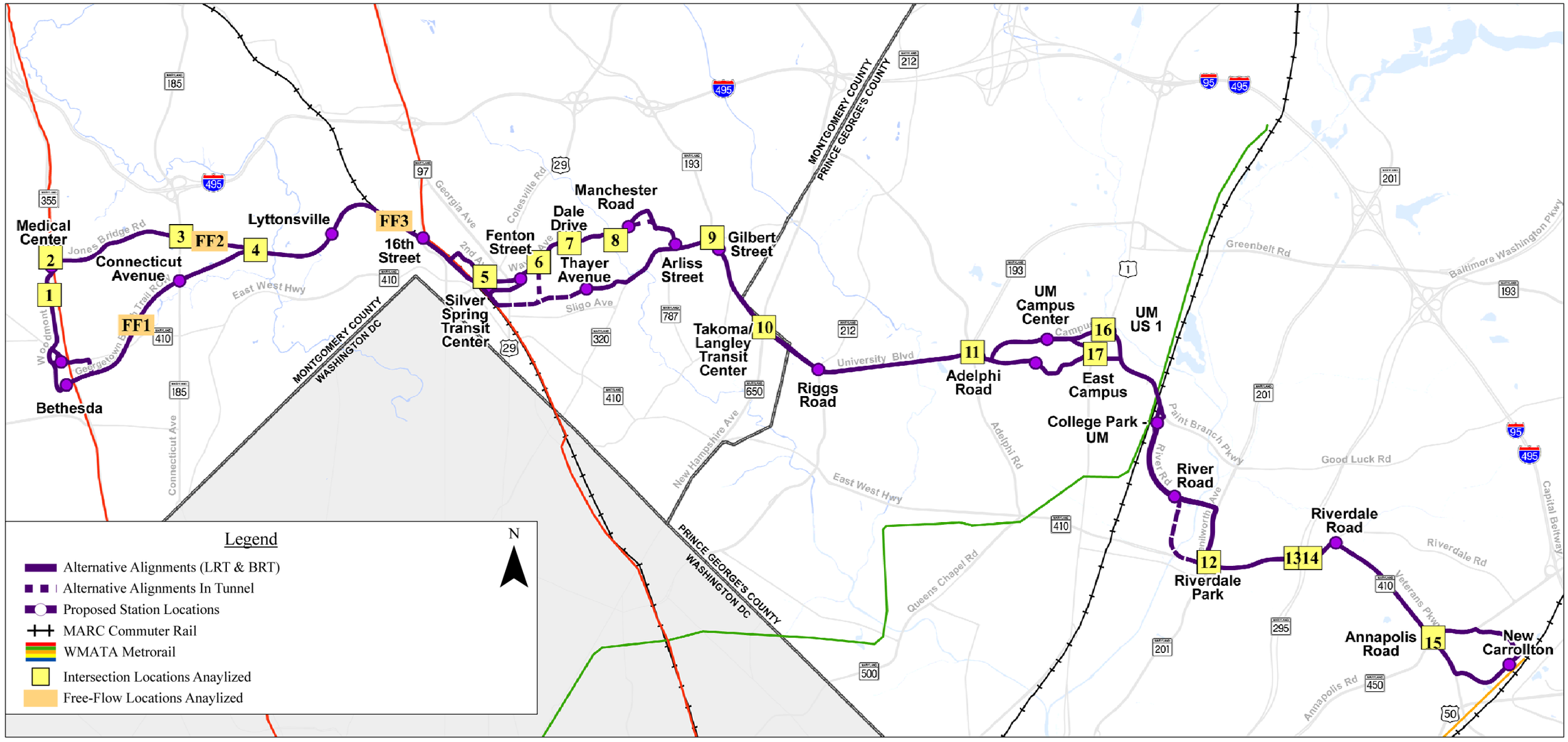


Table 4.7-4: Project Level Emission Burden Assessment

Alt	VMT	Pollutant (Kilograms per Day)					Percent Change from No Build				
		CO	NO_x	VOC	PM_{10}	$PM_{2.5}$	CO	NO_x	VOC	PM_{10}	$PM_{2.5}$
No Build	261,054,000	723,722	41,769	21,276	7,022	3,237	--	--	--	--	--
TSM	261,040,000	723,935	41,788	21,284	7,024	3,238	0.02%	0.05%	0.04%	0.03%	0.03%
Low Invest. BRT	261,002,000	723,634	41,769	21,275	7,021	3,237	-0.02%	0.00%	0.00%	-0.01%	-0.01%
Medium Invest. BRT	260,940,000	723,461	41,759	21,269	7,020	3,236	-0.04%	-0.02%	-0.03%	-0.04%	-0.04%
High Invest. BRT	260,879,000	723,291	41,748	21,264	7,018	3,235	-0.07%	-0.05%	-0.05%	-0.06%	-0.06%
Low Invest. LRT	260,887,000	723,281	41,740	21,261	7,018	3,235	-0.07%	-0.07%	-0.07%	-0.07%	-0.07%
Medium Invest. LRT	260,870,000	723,262	41,739	21,261	7,017	3,235	-0.07%	-0.07%	-0.07%	-0.07%	-0.07%
High Invest. LRT	260,867,000	723,254	41,739	21,261	7,017	3,235	-0.07%	-0.07%	-0.07%	-0.07%	-0.07%

Note: **CO=carbon monoxide; NO_x=nitrogen oxides; VOC=volatile organic compounds; PM_{10}=particulate matter (10 microns); $PM_{2.5}$=fine particulate matter (2.5 microns).**

CO_2 emission burdens under the Build alternatives are predicted to demonstrate almost no change (less than 0 .1%) as compared to the No Build alternative. The BRT alternatives are predicted to produce slightly lower CO_2 emission burdens as compared to the No Build alternative. The LRT alternatives are predicted to produce slightly higher CO_2 emission burdens as compared to the No Build alternative. The LRT alternatives are predicted to have slightly higher CO_2 emission burdens as compared to the BRT alternatives due to the larger power requirements estimated for the LRT alternatives LRT power requirements are based on general American Public Transportation Association values for LRT systems. Once a preferred alternative is chosen, it is recommended that these estimates be refined. Considering the scale of these numbers however, and the very small predicted percent changes, differences in the predicted CO_2 emission burdens for the alternatives can be considered insignificant and are not measurably different from the No Build alternative.

Construction Impacts on Air Quality

In general, construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls would be followed. Once a preferred alternative is selected, a quantitative construction analysis would be conducted if it is determined that construction will go beyond five years at one location. This would help to ensure that the project does not cause or exacerbate a violation of the NAAQS, particularly the PM2.5 and PM10 standards, during construction.

Table 4.7-5: CO_2 Emission Burdens

Alternative	Daily Direct Energy (million BTUs)	Total CO_2 (kg)	Percent Change from No Build
No Build	1,489,183	105,662,258	-
TSM	1,489,816	105,707,906	0.04%
Low Investment BRT	1,489,200	105,664,193	0.00%
Medium Investment BRT	1,488,840	105,638,656	-0.02%
High Investment BRT	1,488,495	105,614,187	-0.05%
Low Investment LRT	1,488,825	105,709,291	0.04%
Medium Investment LRT	1,488,751	105,700,348	0.04%
High Investment LRT	1,488,741	105,700,348	0.04%

4.7.3. Conclusions

The purpose and need of the project focuses on meeting the current and future regional transportation needs of the area. The project is not predicted to cause or exacerbate a violation of the NAAQS. The project is not expected to measurably increase regional emission burdens or MSAT levels. The project is also not expected to cause a violation of the $PM_{2.5}$ standard.

Construction-related effects of the project would be limited to short-term increased fugitive dust and mobile-source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls would be followed. Once a preferred alternative is selected, a quantitative construction analysis would be conducted if it is determined that the construction would last longer than five years.

4.8. Noise and Vibration

The construction and operation of the Purple Line has the potential to increase noise and ground-borne vibration in nearby sensitive land uses. Such increases can cause undesirable effects on people, animals, and structures. The principal source of existing noise in the area is vehicular traffic. Within the corridor most adjacent land uses are exposed to low to moderate noise levels. Whether an increase in noise from the construction and operation of the Purple Line results in a noise impact depends largely on the relative relationship between noise generated by the operations of each of the proposed alternatives with that of the existing prevailing background noise levels. More detailed information on noise and vibration can be found in the *Noise and Vibration Technical Report*.

4.8.1. Noise Assessment Criteria

FTA Noise Criteria

FTA noise and vibration impact criteria were used to assess impacts at sensitive sites near the proposed alignments. The criteria are defined in the FTA guidance manual *Transit Noise and Vibration Impact Assessment* (FTA-VA-90-1003-06 May 2006). FTA guidelines define three categories for noise sensitive land uses, see Table 4.8-1. Not only are there different levels of acceptable noise for each category, but how the noise levels are measured and the impact

assessment depends on the type of land use. For example, for residential land uses the noise measurement is cumulative for 24 hours, which reflects a greater sensitivity to noise during the nighttime hours because these are areas where people sleep. For land uses involving daytime and evening uses the noise measurement used is the noisiest hour of transit–related activity.

The FTA noise impact assessment criteria establishes noise impacts based on varying scale of impact generated by the transit noise source. Project impacts are categorized as “No Impact”, “Moderate Impact”, or “Severe Impact” based on the allowable limit in project-generated noise exposure over the existing noise exposure.

FTA Vibration Criteria

FTA vibration guidelines apply to transit vehicles operating on the corridor, near stations and other transit facilities. The criteria are based on the maximum vibration level generated by a single event. Like the FTA noise assessment impact criteria, the FTA criteria for acceptable ground-borne vibration are specified for three land use categories, see Table 4.8-2.

4.8.2. Existing Conditions

Existing noise levels within the corridor were assessed based on noise measurements collected in communities bordering the proposed alignments. Physical and operational parameters which would produce the worst-case noise effect, such as train speed, frequency of operation, and distance to track were accounted for in the selection of representative 24-hour noise measurement sites. In some cases noise measurement sites were determined to be representative sites within a given land use category for existing and future noise conditions. This occurred when all the properties in a given location shared the following characteristics:

Table 4.8-1: FTA Land Use Categories for Transit Noise

Land Use Category	Description of Land Use Category
1	Tract’s of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, and such land used as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use.
2	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Institutional land uses with primary daytime and evening use. This category includes schools, libraries, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Table 4.8-2: FTA Land Use Categories for Ground-borne Vibration

Land Use Category	Description of Land Use Category
1	Buildings where low ambient vibration is essential for interior operations
2	Residences and Buildings where people normally sleep
3	Institutional land uses with primarily daytime use

- Proximity to the Purple Line where maximum exposure to transit noise may potentially occur
- Similar type and density of housing, such as single family homes or multi-family housing

Measured Existing Noise

Daytime peak hour existing noise levels were recorded at seven FTA Category 1 sites. These are parks identified within the corridor where quiet is an essential element in their intended use.

Noise levels were recorded for 24 hours at 57 FTA Category 2 land uses, consisting mainly of residential properties. MTA requested access to residential properties throughout the corridor to monitor existing noise levels, but received consent from a limited number of property owners. Due to these property access restrictions, long term 24-hour noise measurements were only collected at 23 of the 57 impact assessment sites. Noise measurements were estimated for the remaining 34 properties by the FTA population density methodology.

FTA Category 1 Sites

- Rock Creek Stream Valley Park
- Long Branch Park
- Sligo Creek Stream Valley Park (two locations)
- Anacostia River Stream Valley Park (two locations)
- West Lanham Hills Park

The location of all representative noise measurement and impact assessment locations are depicted in Figure 4.8-1. Measured existing day-night noise levels were found to be within the typical range of suburban communities.

Institutional FTA Category 3 uses are interspersed along the alignments, but are not differentiated from the more sensitive residential uses.

When noise measurements are not possible, existing noise exposure can be determined by use of population density. In areas 1000 feet or more away from other major noise sources, such as major roadways or railroads, noise in neighborhoods can be estimated using a relationship determined during a 1974 research program by the US EPA. The research determined that ambient noise level is a function of population density at locations away from transportation corridors.

Within the Purple Line corridor, existing noise exposure was estimated by first looking at a site’s proximity to existing major roads and railroad lines. If these noise sources are far enough away that ambient noise is dominated by local streets and community activities, then the estimate is made based solely on population density. The decision on which to use was made by comparing the noise levels from each of these three categories (railroads, roadways, and population density) and selecting the highest level.

Existing Vibration Levels

The proposed alignments for the Purple Line are currently exposed to vibrations generated predominately from trucks and buses traveling on existing roadways. Typical vibration levels generated from road traffic movements are in ranges below the FTA vibration impact thresholds.

Figure 4.8-1: Noise Measurement Locations

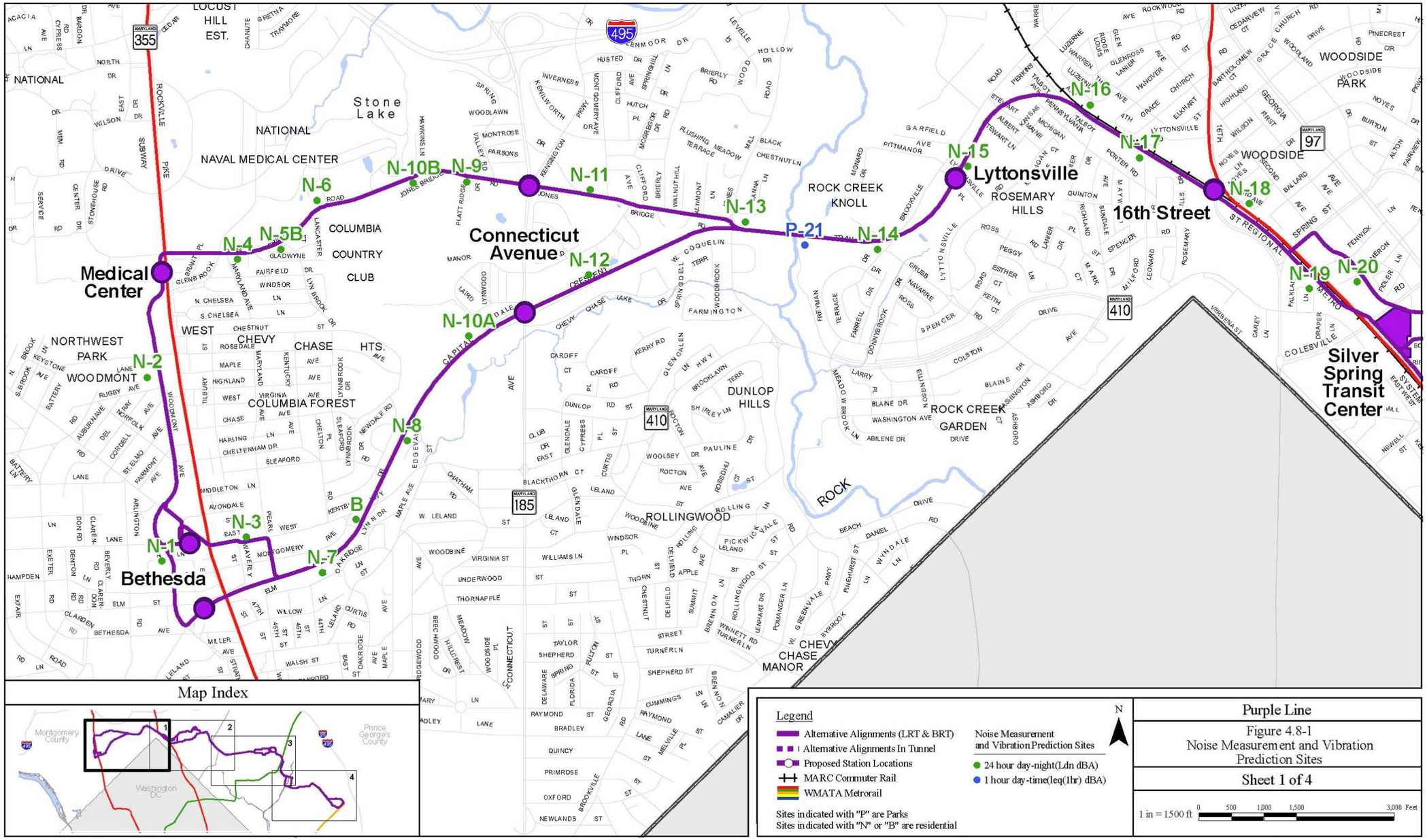


Figure 4.8-1: Noise Measurement Locations (continued)

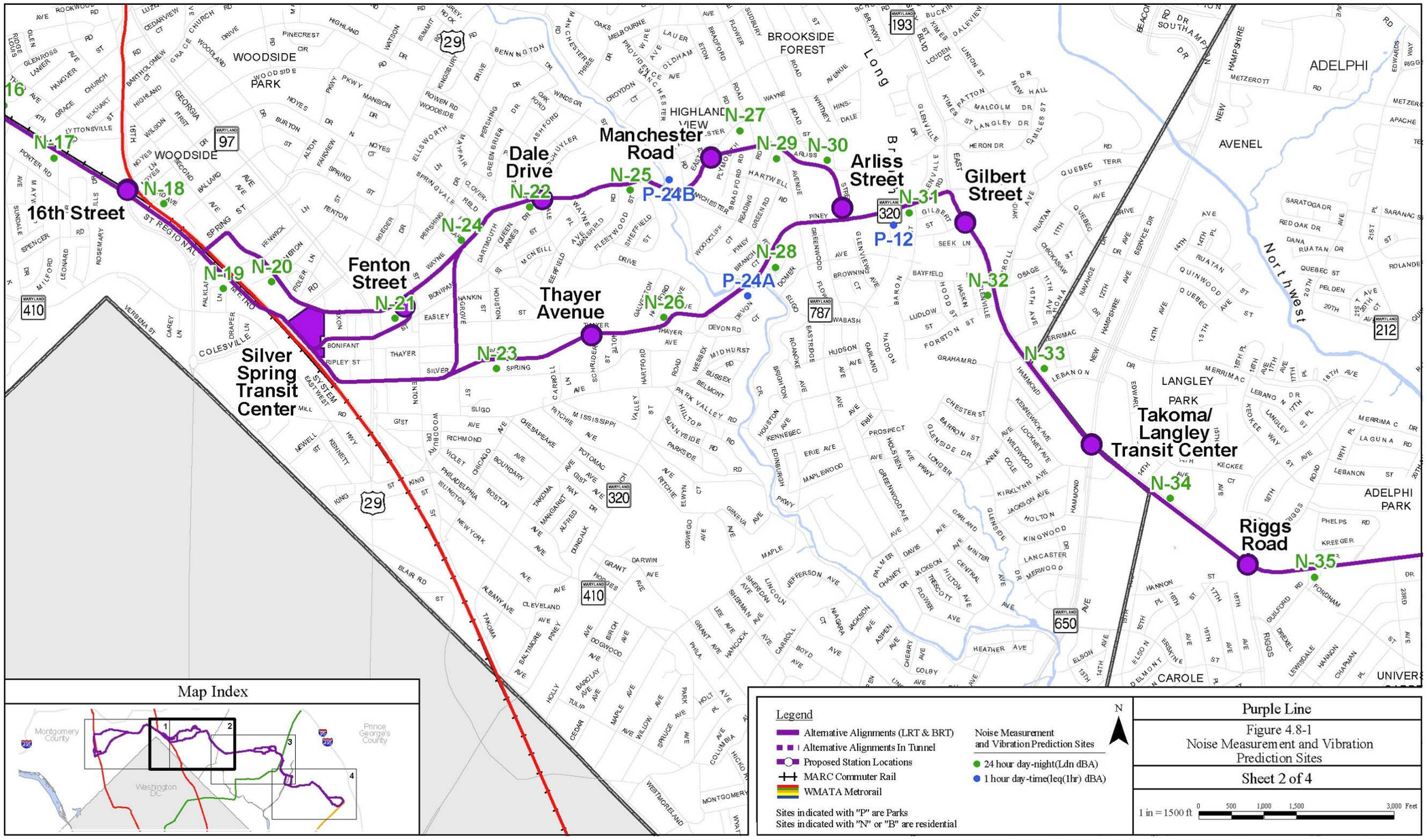


Figure 4.8-1: Noise Measurement Locations (continued)

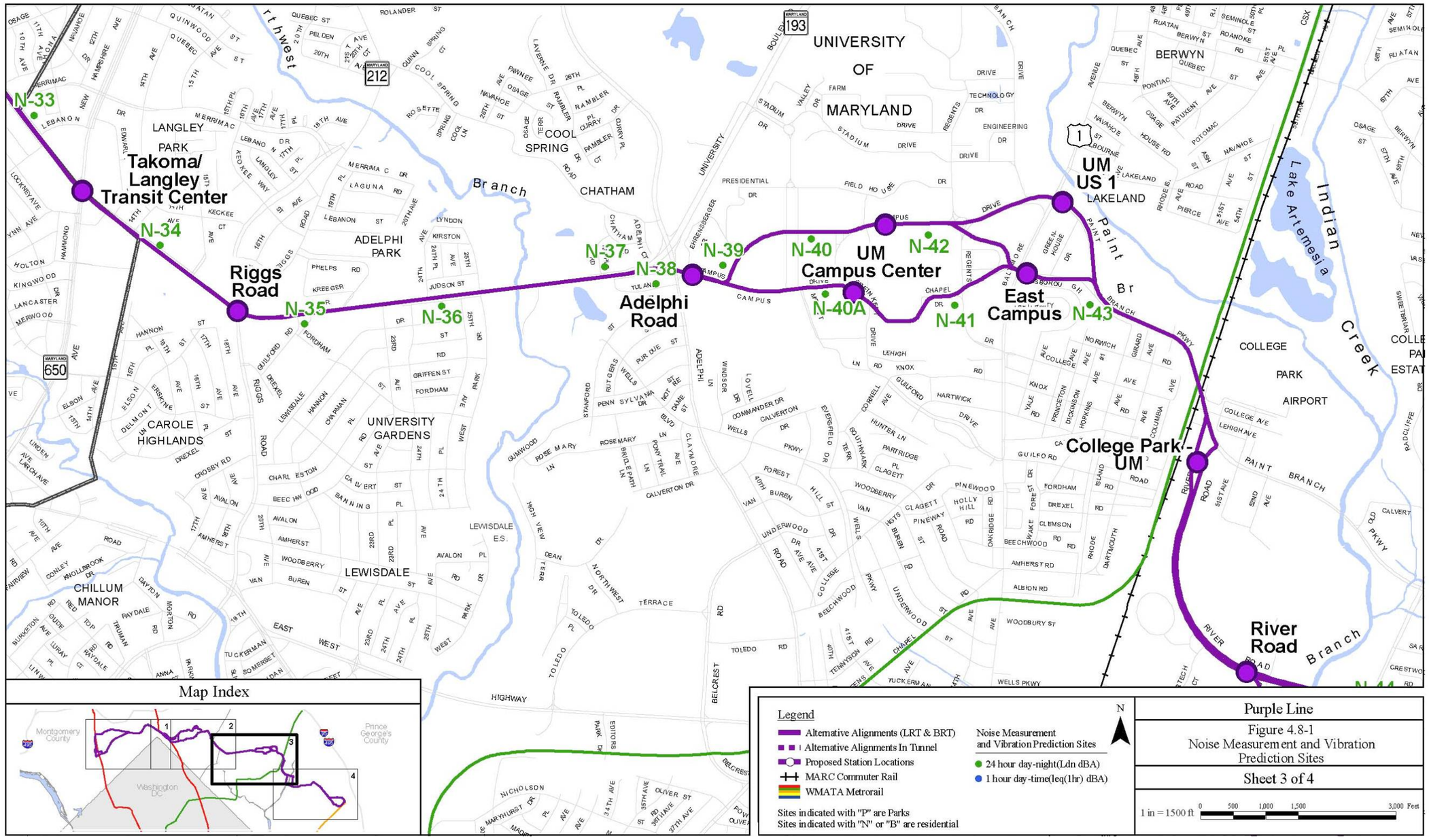
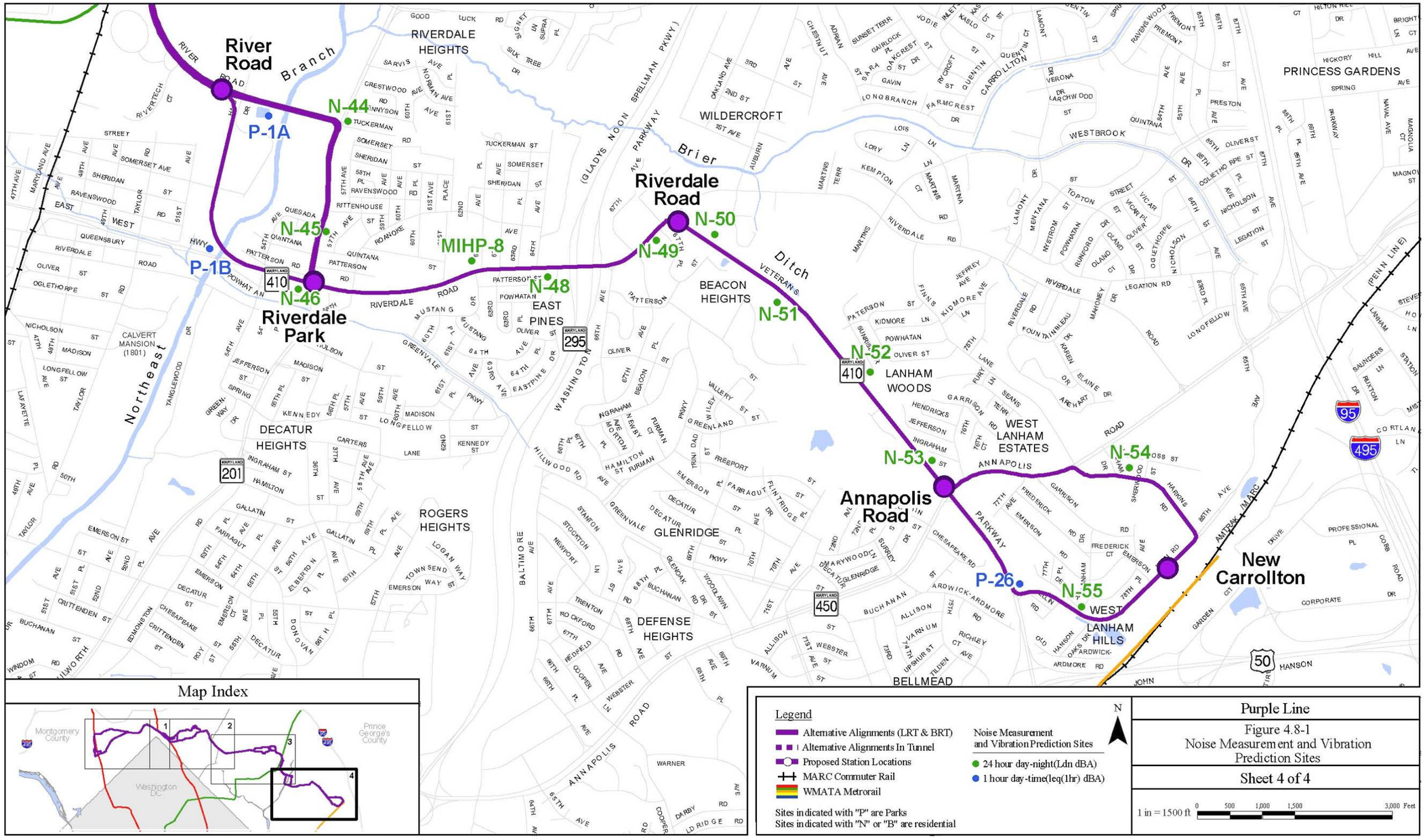


Figure 4.8-1: Noise Measurement Locations (continued)



4.8.3. Environmental Consequences

This section discusses the potential noise and vibration impacts of the Purple Line. In addition, construction noise and vibration are qualitatively evaluated.

In the next phase of the project the potential for vibration impacts to sensitive receptors such as the University of Maryland research labs will be more closely evaluated.

Expected Noise Exposures: Transit Line Operations

Noise from transit line operations was estimated following procedures and guidelines contained in the FTA *2006 Transit Noise and Vibration Guidance Manual*. The procedure describes vehicle noise emissions and quantifies the attenuation of sound as it travels from the vehicle to noise-sensitive receptor locations along the right-of-way. The sound propagation assumptions generally are conservative and therefore tend to result in over-prediction of noise exposure.

Prediction Procedures

Every noise prediction must characterize three elements, the noise source, the sound propagation path, and the affected noise receptor. In this study, residences along the right-of-way are the primary focus. Schools, churches, libraries, medical facilities, and parklands are also of concern.

The Purple Line would be light rail vehicles or hybrid-electric buses Noise emissions depend upon the operating conditions; for buses the factors are vehicle speed and rate of acceleration; and for light rail cars they are speed and track type (tie-and-ballast or embedded in the roadway pavement).

Analysis Inputs and Assumptions

Land uses where noise impacts were measured along the corridor are either residential FTA Category 2 land uses where nighttime sensitivity to noise is assumed to be of utmost importance; parkland, FTA Category 1 land uses, where quiet is an essential element of their intended purpose; or institutional FTA Category 3 uses. These latter uses are interspersed along the alignments, but are not differentiated from the more-sensitive residential uses. Impacts to non-sensitive commercial or industrial (i.e., not represented by an FTA land use category) were not evaluated.

As noted earlier, project-generated noise exposures were estimated at 57 representative FTA Category 2 properties, predominately single family residential properties, and at seven FTA Category 1 parkland sites. Transit line operations for the proposed Purple Line LRT service would be provided by two 90-foot car trains. BRT service most likely would be provided by 60-foot, articulated, diesel/electric hybrid buses. Normal service would be provided for 19 hours of the day during weekdays starting from 5 AM in the morning running all day until 12 AM (midnight) except Friday and Saturday night when service would be provided until 3 AM, thereby providing 22 hours of service during these two days. To provide the most conservative approach the noise analysis was completed for a 22-hour service time period.

Predicted Noise Levels

Detailed findings of the entire noise study can be found in the *Noise and Vibration Technical Report*. A summary of the transit noise impact findings within the corridor for each of the proposed alternatives is presented in Table 4.8-3.

The transit operations findings indicate that noise generated from LRT line operations will be below the FTA impact thresholds throughout the Purple Line system due largely to the presence of vehicle skirts placed on all Purple Line light rail vehicles. In addition, the proposed build condition within the Georgetown Branch right-of-way includes the construction of a four-foot retaining wall on one side and a four foot noise wall on the other side which will provide additional noise reduction from light rail vehicles traveling within the narrow confines of the right-of-way.

The use of vehicle skirts and walls are design features which are an integral part of the project definition. The combined effect of both LRT vehicle skirts and incorporation of walls as part of the project build design will ensure that noise exposure from LRT operations at nearby residential communities are below the FTA impact threshold throughout the limits of the Purple Line corridor operations.

Vehicle skirts are panels that cover the wheels of light rail vehicles. Because most of the noise generated by LRT operations is from the wheels on the rails, panels are very effective at reducing the noise impacts of light rail vehicle operations.

Light Rail Vehicle with Skirts

Light Rail Vehicle without Skirts

Noise impacts identified under the various BRT alternatives from line operations, shown in Table 4.8-3 indicate that noise impacts will be limited to three moderate impacts at Sites N-17, N-24, and N-25 under Low Investment BRT and six moderate impacts at Sites N-17, N-19, N-22, N-24, N-25, and N-30 under Medium and High Investment BRT. Estimated BRT levels were determined to be in the lower end of the impact scale averaging 1 to 3 dBA above the FTA impact threshold. These impacts would be clustered in Montgomery County in the general area of Silver Spring along the CSX corridor, and along Wayne Avenue and ending at Arliss Street.

Expected Noise Exposures: Wheel Squeal

One noise impact exclusive to LRT is wheel squeal. Wheel squeal occurs when trains make sharp turns; the sharper the turn, the more likely wheel squeal will occur. Railcars are supported on each end and guided through curves by a swiveling truck consisting of two pairs of wheels with parallel axles. Since the axles are held rigidly by the truck frame, they cannot take up radial positions as the car traverses a curve. Consequently, the wheels must slide sideways across the rail top as well as roll along its length. The lateral sliding of the wheel over the rail head creates rubbing forces on the wheel which, if

Table 4.8-3: Noise Impacts Generated From Line Operations

Site #	Description	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
N-17	Leonard Drive	Moderate Impact	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact
N-19*	16th Street between East West Highway and Spring Street	N/A	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact
N-24	Wayne Avenue between Cedar Street and Cloverfield Road	Moderate Impact	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact
N-22	Wayne Avenue between Dartmouth Avenue and Dale Drive	No Impact	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact
N-25	Wayne Avenue between Mansfield Road and Sligo Creek Parkway	Moderate Impact	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact
N-30	Arliss Street between Flower Avenue and Walden Road	No Impact	Moderate Impact	Moderate Impact	No Impact	No Impact	No Impact

Notes:

* Existing noise levels (Ldn) were estimated from neighborhood population densities.

N/A Not Applicable (alignment does not pass by this area)

Under the FTA criteria, for land uses not involving sleep (non-residential land use) peak hour Leq (1hr) dBA was used for noise impact assessment purposes.

LRT Headways of 15 minutes from 5 AM to 6 AM and 8:30 PM to 3 AM, 10 minutes from 6 AM to 6:30 AM, 9 AM to 3:30 PM and 6:30 PM to 8:30 PM, 6 minutes from 6:30 AM to 9 AM, and 3:30 PM to 6:30 PM were used for the operational LRT noise impact assessment. There is no service from 3 AM to 5 AM.

BRT Headways of 15 minutes from midnight to 3 AM and 8:30 PM to 3 AM, 12 minutes from 10 AM to 3 PM, and 8 PM to midnight, 8 minutes from 9 AM to 10 AM, 6 minutes from 5 AM to 9 AM, and 3 PM to 8 PM were used for the operational BRT noise impact assessment. There is no service from 3 AM to 5 AM.

conditions are suitable, will cause its vibration to grow until high stable amplitude is reached. The wheel vibration is radiated as squeal noise characterized by one or more intense, high-pitched tones at the natural vibration frequencies of the wheel.

Track with curve radius less than 750 feet and near residential or other noise sensitive uses has the potential to generate wheel squeal noise annoyance. Tables 4.8-4, 4.8-5, and 4.8-6 list areas of the alignments where track curves are sharp enough that potential wheel squeal annoyance may occur under Low, Medium, and High Investment LRT, respectively. The maps in Figure 4.8-1 identify the potential areas indicated in the tables. Seventeen potential locations of possible wheel squeal noise along the Low Investment LRT alignment were identified. Due to some unique design options being considered under the Medium Investment Alternative, eighteen potential areas of wheel squeal noise annoyance were identified, whereas fourteen potential annoyance zones where identified under the Low and High Investment Alternatives.

Expected Noise Exposures: Operations, Maintenance, and Storage Facilities

Within the corridor there are two proposed maintenance and storage facilities. One facility is located on Brookville Road in Montgomery County near the Lyttonsville community, adjacent to noise monitoring Sites N-14 and N-15. The other facility is the site of the Glenridge Maintenance Facility of the Prince George's County Parks Department off the southwest side of Veterans Parkway near the West Lanham Shopping Center, adjacent to noise monitoring Site N-53. Noise level estimates of maintenance and storage operations were determined for the LRT and BRT alternatives following FTA impact assessment procedures.

Table 4.8-4: Potential Areas of Wheel Squeal Noise Annoyance for Low Investment LRT

Nearest Receptor Within 300' of Tracks
N-21
N-25
N-30
N-30, N-31
N-31
N-39
N-43
N-43
N-44
N-46
N-49, N-50
N-53
N-54

Table 4.8-5: Potential Areas of Wheel Squeal Noise Annoyance for Medium Investment LRT

Nearest Receptor Within 300' of Tracks
N-21
N-21
N-25
N-25
N-25
N-30
N-30, N-31
N-31
N-40A
N-40A
N-41
N-43
N-43
N44
N-46
N-49, N-50
N-55
N-55

Table 4.8-6: Potential Areas of Wheel Squeal Noise Annoyance for High Investment LRT

Nearest Receptor Within 300' of Proposed Tracks
N-25
N-25
N-25
N-30
N-30, N-31
N-31
N-39
N-43
N-43
MIHP-8
N-49
N-55
N-55

It is anticipated that BRT operations at the Lyttonsville facility would result in moderate impacts to residences adjacent to Sites N-14 and N-15 under all the BRT alternatives.

No impacts under any BRT alternatives are predicted at Site N-53 from the Glenridge Facility.

Under LRT build design conditions at the Lyttonsville facility no noise impacts are anticipated at Sites N-14 and N-15. At the proposed Glenridge facility noise generated from maintenance and storage activities for LRT would result in noise levels reaching the FTA severe impact threshold for nearby residential areas. At the proposed Glenridge facility, the dominate noise contribution is from wheel squeal generated from the curved tracks scattered throughout the facility which provide access to and from the facility.

Potential BRT and LRT Vibration Impacts

Vibration impacts under BRT build design conditions were limited to Site 10A at the edge of the Columbia County Club under Medium and High Investment BRT within a 25 foot zone of the alignment centerline. Residences living nearby along Newdale Road would not experience vibration impact because they are located further way.

The LRT alternatives are anticipated to produce vibration impacts above the FTA threshold along the Georgetown Branch right-of-way at three locations along the Georgetown Branch right-of-way: Site N-B 4242 East West Highway, Site N-8 Edgevale Court, and Site N-10A at the boundary of the Columbia Country Club.

Within the Georgetown Branch right-of-way, structures located within 40 feet of the proposed LRT centerline coupled with light rail train travel speeds in excess of 35 mph are expected to experience vibration levels at or above the FTA 72 VdB impact threshold for Category 2 land uses for all three LRT alternatives.

Construction Noise and Vibration

Noise and vibration impacts from construction are generated by construction equipment and activities; the proximity of construction activities to sensitive land uses, and the duration of construction activity.

While standardized criteria have not been established for noise or vibration associated with construction, the FTA *Transit Noise and Vibration Impact Assessment Manual* present guidelines that “can be considered reasonable criteria for assessment” of construction noise impacts. In addition, the Maryland Noise Statute sets ambient noise level limits within residential communities which construction generated noise activities can not exceed. Construction within the project area would cause short-term noise effects on properties in the immediate vicinity of the construction. Effects on community noise levels during construction would result from noise from construction equipment and from construction and delivery vehicles. The level of effect would depend on the noise characteristics of the equipment and activities involved, such as the duration of the activity, construction schedule, and distance from receptors. Resultant noise levels at a given property would depend on the type and number of pieces of construction equipment being operated and the distance from the construction site. Noise levels from construction activities can vary widely, depending on the phase of construction, which include land clearing and excavation required for building either the LRT or BRT Medium and High Investment Alternatives. Construction equipment used to widen existing roadways or build retaining walls will also generate noise. At a typical near by property, noise levels would be highest during the early phases of construction, when excavation and heavy truck traffic would occur.

4.8.4. Mitigation Measures for Noise Associated with Line Operation, Maintenance and Storage Facilities and Construction

There are a range of mitigation measures which can be adapted to effectively reduce or mitigate both line operation and construction-related noise and vibration impacts.

BRT Line Operation Noise Mitigation

Moderate noise impacts estimated from each of the BRT Alternatives are anticipated to be in the low range of the impact scale, averaging 1 to 3 dBA above the FTA impact limits. Noise generated from BRT operations of less than 4 dBA can be eliminated by the construction of 4-foot wall type barriers. This design configuration provides a natural line of sight break between the buses traveling on the BRT alignment and the nearby residential properties.

LRT Line Operation Noise Mitigation

As part of the project definition vehicle skirts are to be placed on all light rail vehicles. In addition within the entire length of the Georgetown Branch right-of-way walls on either side of the transitway are part of the project build design. As a consequence of these project design commitments, no impacts are anticipated to occur from LRT line operations and therefore no mitigation is required. The combined affect of vehicle skirts and four-foot walls has an effective acoustical effect of providing ten decibels of noise reduction, thereby ensuring noise levels stay below FTA impact limits.

Maintenance and Storage Facilities Noise Mitigation

The moderate and severe noise impacts which would be anticipated from the maintenance and storage facilities for either BRT or LRT can be mitigated by concrete noise barriers adjacent to the affected residential communities.

At the proposed Lyttonsville facility noise barriers adjacent to the effected residences within the communities covering Sites N-14 and N-15 would provide sufficient noise reduction to mitigate all the moderate impacts anticipated. At the Glenridge site, a noise barrier approximately 2000 feet in length, running parallel to Veterans Parkway from approximately Ingraham Street at its most southern point to Sunrise Drive at its most northern extent, would provide acoustically effective noise reduction from maintenance and storage operations.

Vibration Mitigation

Ground-borne vibration generated from LRT and BRT systems is not as common a problem as environmental noise, and as a result mitigation

measures are not as well defined. When buses cause annoying ground-borne vibration the source of the problem is usually roadway roughness or discontinuities in the roadway. In the case of LRT systems, proper maintenance of wheels and rails is essential in controlling ground-borne vibration. Improperly maintained wheels or rails can increase vibration levels over time up to 20 VdB. Rail grinding and wheel truing on a regular basis will provide reductions of 10 to 15 VdB. In the case of the Purple Line, the ground-borne vibration exceedances reported at properties within the Capital Crescent Trail (Sites N-B, N-8 and N-10A) are slightly above the FTA impact threshold and with proper track and wheel maintenance these impacts will cease to exist.

Construction Generated Noise Mitigation

Construction noise is regulated by local and State ordinances, and Federal Highway Administration (FHWA) regulations. FHWA requirements mandate that certain classifications of construction equipment and motor vehicles meet specified noise emission standards; that, except under very special circumstances, construction activities be limited to weekdays between the hours of 7 AM and 6 PM; and that construction material be handled and transported in a manner as to not create unnecessary noise.

When feasible, quieter pile driving alternatives (e.g., drilled piles or sonic piles) should be used. These methods would be recommended where geological conditions permit their use. When working outside state-owned rights-of-way, hours of noisy construction would be limited, as specified in local municipal ordinances.

FHWA regulates construction noise through the following process:

- Identify land uses and activities that may be affected during construction.
- Determine the measures, needed to minimize or eliminate adverse construction-noise effects on the community.
- Prior to the start of construction, incorporate needed abatement measures in project plans and specifications.

Project-specific construction noise abatement that can be utilized to minimize, the noise impact in areas outside the construction site boundary, should include the following:

- Utilize shields, impervious fences or other physical sound barriers to inhibit transmission of noise.
- Utilize sound retardant housings or enclosures around noise producing equipment.
- Use acoustically effective intake and exhaust mufflers on internal combustion engines and compressors.
- Line or cover hoppers, storage bins and chutes with sound absorbing material.
- Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.
- Route construction equipment and other vehicles carrying spill, concrete or other materials over streets and routes that will cause the least disturbance to residents in the vicinity of the activity.
- To the extent possible, position stationary construction equipment away from residential areas to minimize the noise impact on the community.

4.9. Habitat and Wildlife

The No Build and TSM Alternatives would not involve any project-related construction or changes to the habitat and wildlife in the corridor. Consequently, project-related environmental effects from the No Build or TSM Alternatives are not anticipated, and these alternatives are not included in the detailed discussions of natural environmental effects that follow. All of the Build alternatives would have direct or indirect effects on habitat and wildlife within the corridor. Information on existing conditions of each resource and the potential effects of the project on these resources are summarized below. The majority of the impacts are discussed by alternative, which incorporate multiple design options as part of the overall impact analysis for each alternative. Therefore, the impacts represented for each resource by alternative will most likely be lower than this "worst-case" analysis, as redundant impacts from multiple design options are removed once the design for the alternative is refined. More detailed information on existing conditions and potential impacts to natural resources discussed within this report can be found in the *Natural Resources Technical Report*.

The 16-mile Purple Line corridor is located primarily within urban and suburban areas. As such, very few areas within the corridor support natural habitats. The portions supporting larger tracts of natural forested habitat occur primarily within the larger stream valleys, such as Rock Creek, Sligo Creek, Northwest Branch, Paint Branch, Northeast Branch, and an unnamed tributary to Brier Ditch, as shown in Figure 4.9-1. The remainder of the corridor contains smaller patches of vegetation typically found in disturbed areas that occurs in the Georgetown Branch right-of-way which includes the Columbia Country Club; along smaller tributary streams; within small community parks (e.g., Adelphi Park); on the campus of the University of Maryland at College Park; as buffers adjacent to residential, commercial, institutional, and industrial development; and within transportation and utility rights-of-way.

Impacts to non-forested habitats, such as managed lawns, landscaped areas, and old field habitat, would occur from each of the Build alternatives. These impacts, however, should be relatively minor, as the Build alternatives would generally be located within or along existing roadways. In many locations, managed lawns and landscaped areas that may be disturbed would be restored following construction. The vegetation within the Georgetown Branch right-of-way would also be removed to accommodate the Purple Line and the permanent Capital Crescent Trail. Forested habitat impacts would also result from each of the Build alternatives and their component options. Of these, High Investment BRT with the Silver Spring/Thayer Avenue design option would have the highest impact to forests (24.62 acres), while Low Investment BRT would have the lowest impact (10.70 acres) to forests as shown in Table 4.10-1. These impacts are expected to decrease once the engineering and design of each alternative is refined.

Of the two maintenance and storage facility sites, the Lyttonsville site would have no impact on forest habitats; and the Glenridge facility would impact 5.3 acres of forest habitat.

Forests in Maryland are regulated under the Forest Conservation Act (Act), Natural Resources Article, Section 5-1609, Annotated Code of Maryland. Before a sediment and erosion control permit is issued for a project, the Act requires that a Forest Stand Delineation (FSD) and a Forest Conservation Plan (FCP) be submitted and approved by the Maryland Department of Natural Resources (DNR), Forestry Division. A more detailed forest assessment, including preparation of a FSD and FCP, will need to be completed for the project once an alternative has been selected and more detailed design has been completed.

Figure 4.9-1: Woodlands

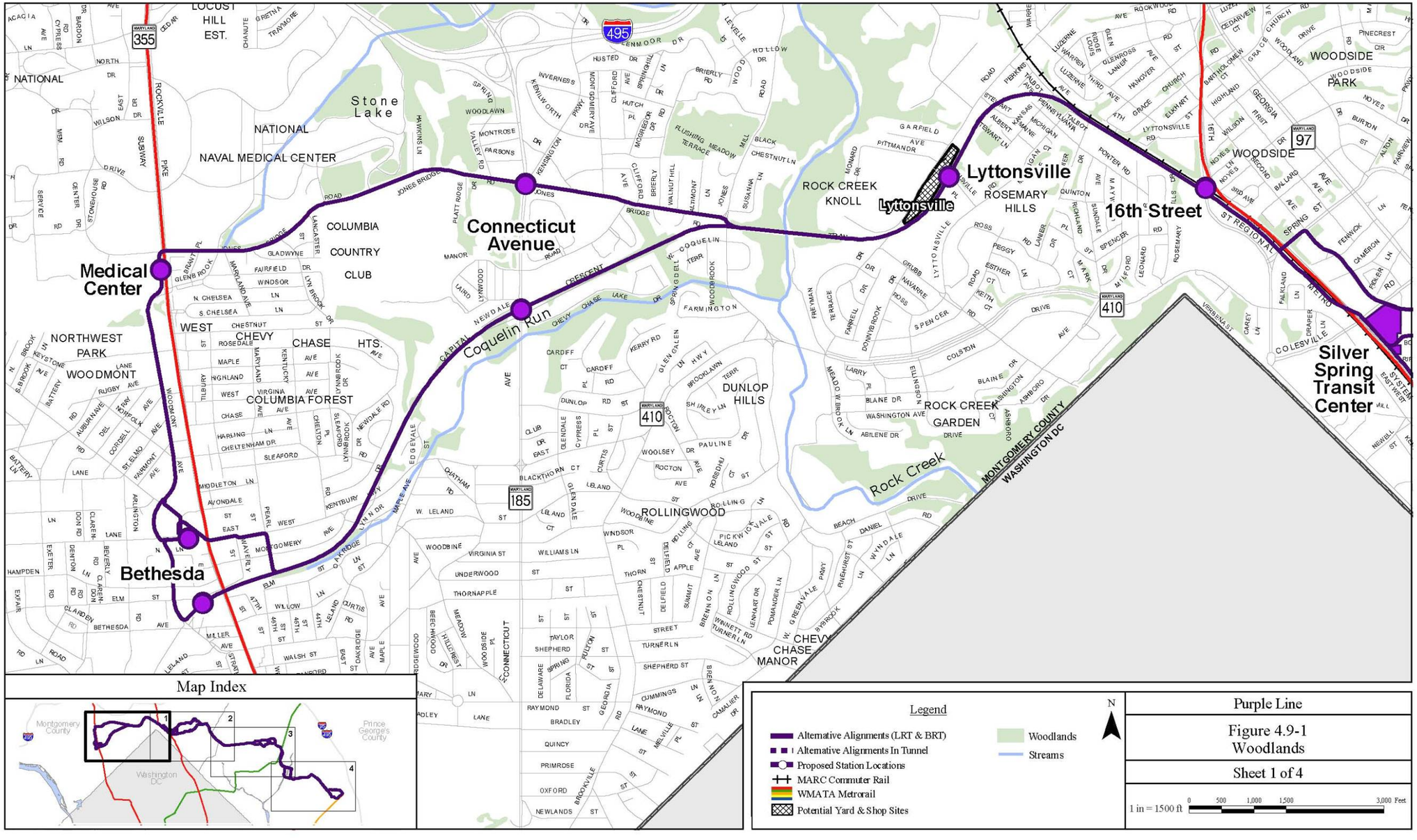
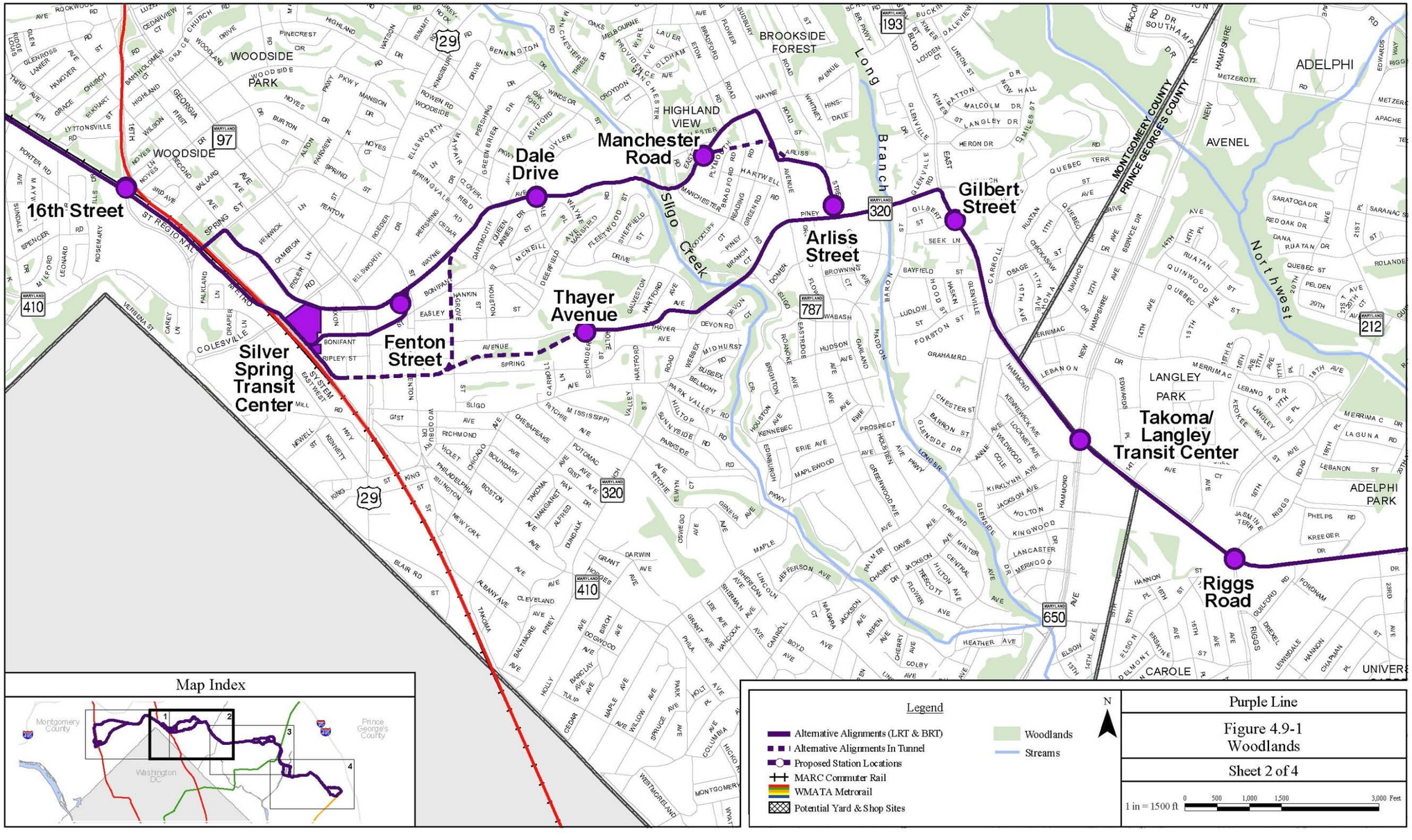


Figure 4.9-1: Woodlands (continued)



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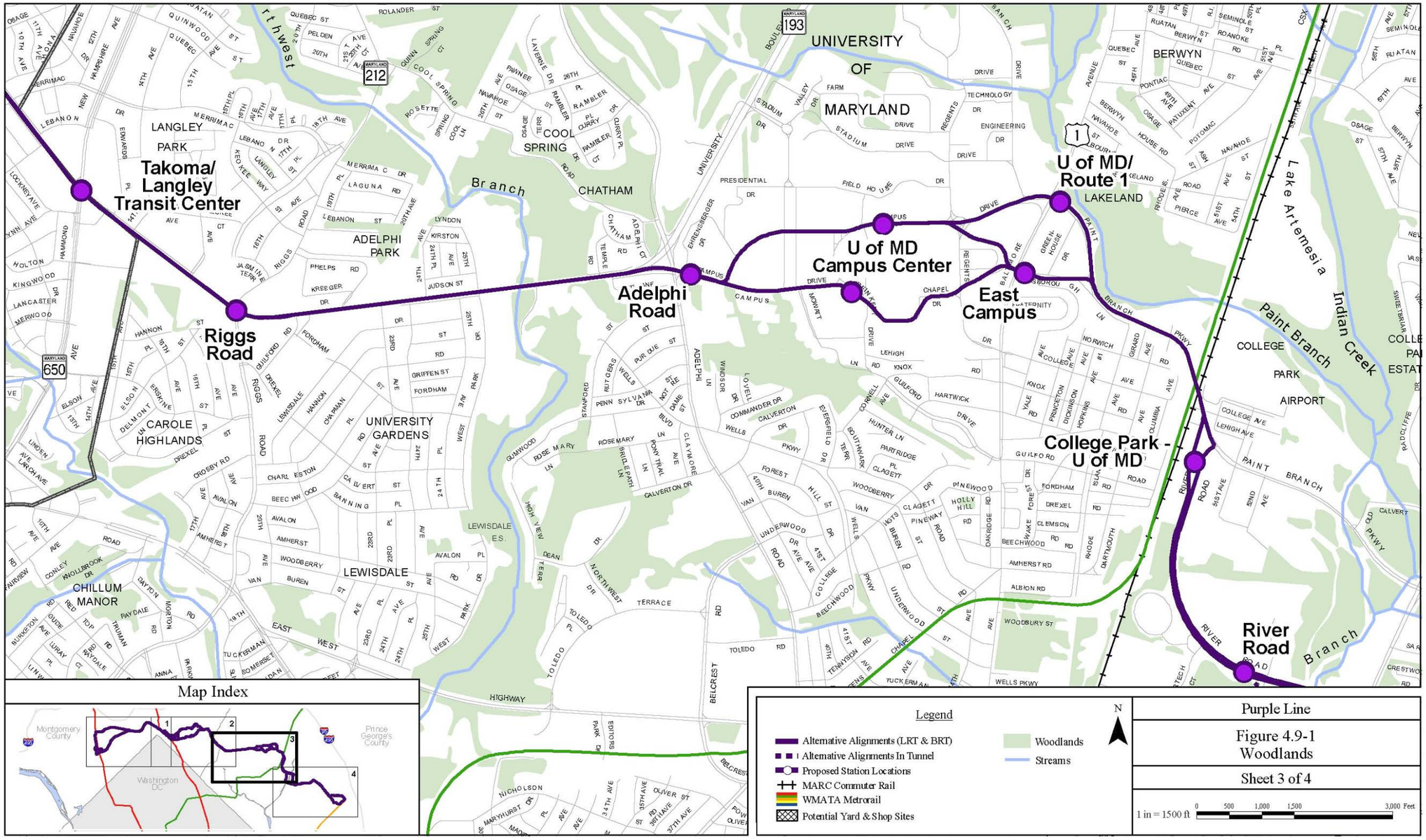
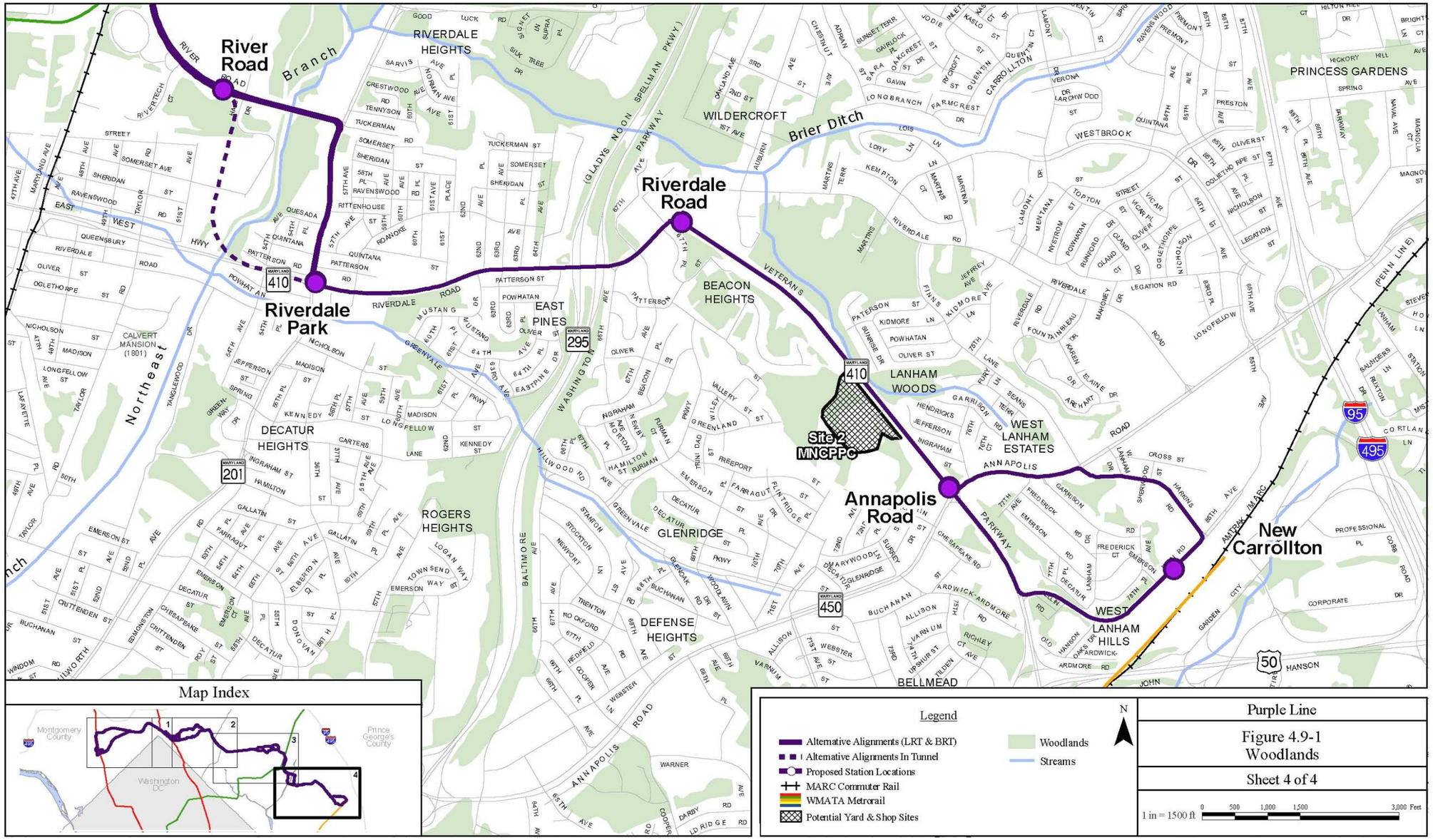


Figure 4.9-1: Woodlands (continued)



4.9.1. Significant Trees

Significant trees with a diameter breast height size of 30 inches or greater or with a diameter that is at least 75 percent of the state champion tree for a given species were not specifically identified within the corridor during this stage of the planning process. However, forested areas and neighborhoods with street trees that appeared to contain a number of significant trees were mapped for identification. The delineation and surveying of these significant trees will occur following the selection of a preferred alternative.

4.9.2. Terrestrial Wildlife

The presence of terrestrial wildlife within the corridor is a function of available habitats. Because of the urban and built up land uses within the corridor, native wildlife species are expected to be primarily restricted to less developed areas, such as the riparian corridors of Rock Creek, Sligo Creek, Northwest Branch, Paint Branch, Northeast Branch, and an unnamed tributary to Brier Ditch. The habitat within the urban and built up land uses, however, provides a variety of niches for commonly-occurring, native, opportunistic, and suburban-dwelling species of small and mid-size mammals and birds. These species utilize the vertical structure provided by poles, buildings, and landscaping for perching, resting and nesting; the fruits and seeds provided by the landscaping and invertebrates inhabiting the lawns for foraging; and waste products left unprotected for scavenging.

This habitat does not provide significant habitat for any rare, threatened, or endangered species of wildlife, and none were observed utilizing this habitat.

The DNR agency coordination letter dated April 6, 2007 stated that FIDS habitat may occur within the Purple Line project area. Larger forested patches along the corridor serve as habitat for forest interior dwelling bird species (FIDS). FIDS depend upon large, contiguous forest stands to successfully breed and produce sustainable populations. FIDS typically require forests of at least 100 acres or riparian forests at least 300 feet wide to maintain viable breeding populations (Robbins et al. 1989).

Because the Build alternatives would mostly follow existing roadway alignments, impacts to wildlife resources are anticipated to be minor, and any wildlife corridors, especially within stream valley parks, would be maintained. Impacts to FIDS habitat are also anticipated to be minor for the same reasons stated above. The only areas of forest interior habitat occur within the Rock Creek stream valley, the large forested area east of Northwest Branch, north of University Boulevard, and north of Campus Drive within Paint Branch Stream Valley Park. The Purple Line would follow an existing trail or existing roadways through these FIDS habitat areas creating minor encroachment impacts, such as selective clearing of trees and understory vegetation, necessary to accommodate the transitway. Minor encroachment on the edges of FIDS habitat would minimize impacts to the forest interior compared to what would occur if the transitway alignment were to bisect undisturbed FIDS habitat. The FIDS habitat in Rock Creek Park is already bisected by the Georgetown Branch right-of-way and therefore is not undisturbed.

4.9.3. Aquatic Biota and Habitat

Data relating to aquatic biota were gathered from the Montgomery County Department of Environmental Protection, Prince George's County Department of Environmental Resources, and DNR Maryland Biological Stream Survey.

The aquatic habitat and biological communities in most corridor surface waters received poor to fair ratings for fish and macroinvertebrates. Northeast Branch exhibited a more diverse aquatic biota community warranting scores of fair to good. Generally, the physical habitat scores for project area streams were rated from fair to good. The divergent aquatic habitat and biotic community ratings may indicate that other water quality impairments, not measured in state and local government surveys, are impacting the biotic community. More detail on aquatic habitat and species that have been documented are presented in the *Natural Resources Technical Report*. The locations of the water quality sampling sites are shown in Figure 4.9-2.

The National Marine Fisheries Service commented in a letter sent in March 2007 that several major streams and their tributaries within the project corridor may support anadromous and catadromous fish; especially alewife, blueback herring, hickory shad, and American eel. These streams include Rock Creek, Northwest Branch, Paint Branch, Indian Creek, and Northeast Branch.

Historic blockages have prevented anadromous and catadromous fish from moving upstream to spawn. Blockages within Rock Creek and Northwest Branch were identified in 2004 and 2007 during fish surveys conducted for other projects. These blockages occur below the project limits; thereby reducing the likelihood of anadromous and catadromous fish from occurring within project area streams. The blockage on Northeast Branch just south of River Road was modified to permit fish passage in 1991. Anadromous fish were observed just below this modified blockage in 2007. However, the modification of the Northeast Branch blockage could allow for fish to move north of River Road into the area.

The National Marine Fisheries Service recommends avoiding direct impacts to migratory, spawning and nursery activities of anadromous and catadromous fish from construction activities during the migratory and spawning period (February 15th through June 15th). All culverts and bridges should be designed to MDE standards to prevent secondary and cumulative impacts to these types of fish through alteration of habitat. Build alternatives should avoid and minimize creation of instream barriers the block migratory fish from upstream spawning ground, alterations of stream morphometry and hydrology, subtle or incremental changes to instream water quality and hydrology from deforestation of riparian zone, and forested watershed.

Effects to aquatic habitats and species are related to direct loss of habitat from project infrastructure, such as culvert extensions and water quality degradation that could occur from construction and operation of any of the Build alternatives.

Potential impacts during construction include physical disturbances or alterations, accidental spills, and sediment releases that can affect aquatic life. Earth-moving activities would expose unstable soils that can enter waterways during storms. Extension of culverts could lead to direct loss of fish and macroinvertebrates within the construction zone and would permanently alter the available habitat in the impact area. Potential effects to aquatic habitat and water quality would be minimized by strict adherence to sediment and erosion-control plans and stormwater management (SWM) plans, which would be developed in accordance with state regulations to provide long-term mitigation of potential effects from stormwater. In addition, in-stream construction would not be performed during state-mandated stream closure periods, which are from March 1 to June 15 for Use I streams and March 1 through May 31 for Use IV streams. All streams within the corridor are classified as Use I-P, waters designated for water contact recreation, protection of aquatic life, and public water supply, except for a portion of Northwest Branch located north of MD 410, which is designated as Use IV recreational trout waters.

Figure 4.9-2: Watersheds, Water Quality Sampling Locations, and 100 Year Flood Plains

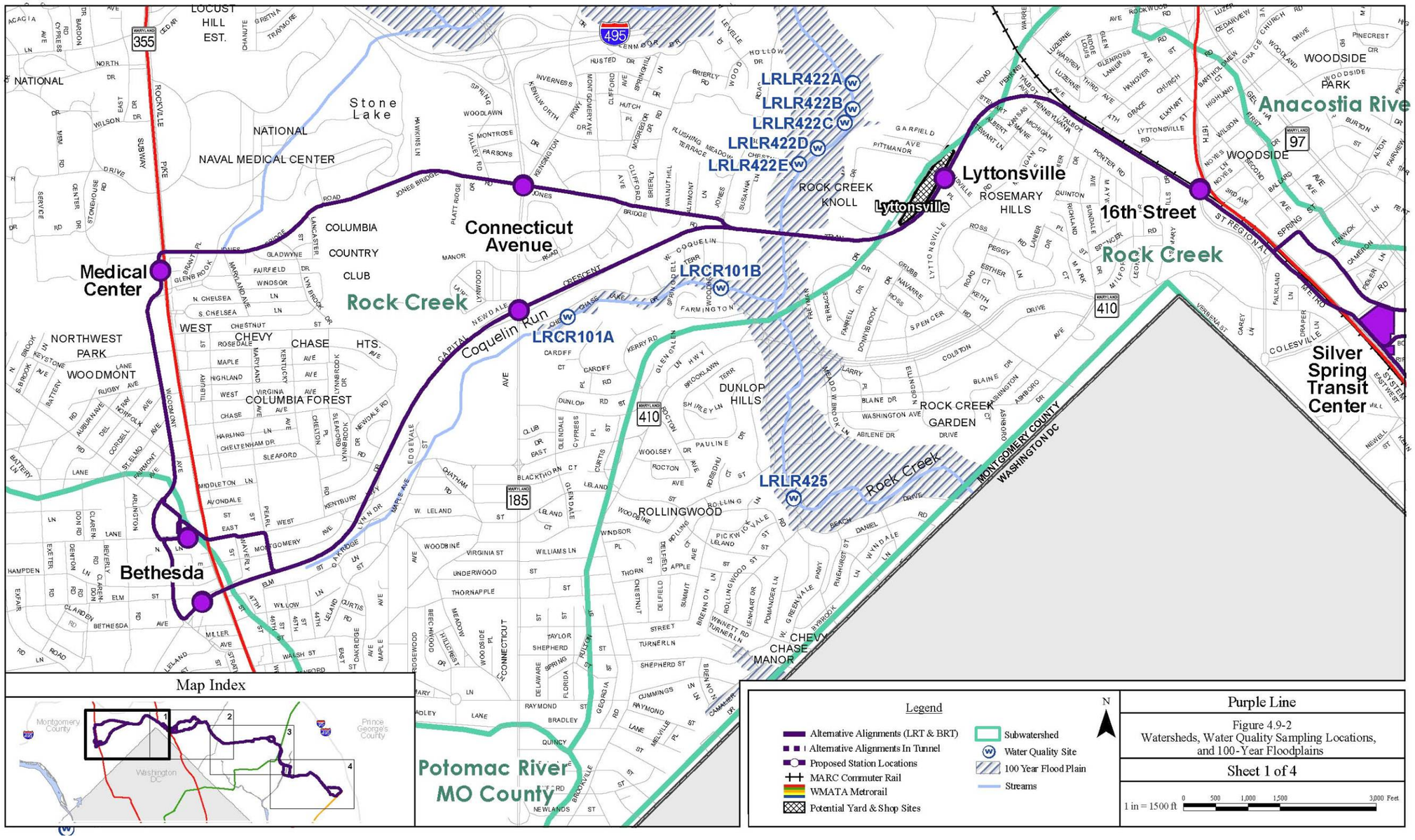


Figure 4.9-2: Watersheds, Water Quality Sampling Locations, and 100 Year Flood Plains (continued)

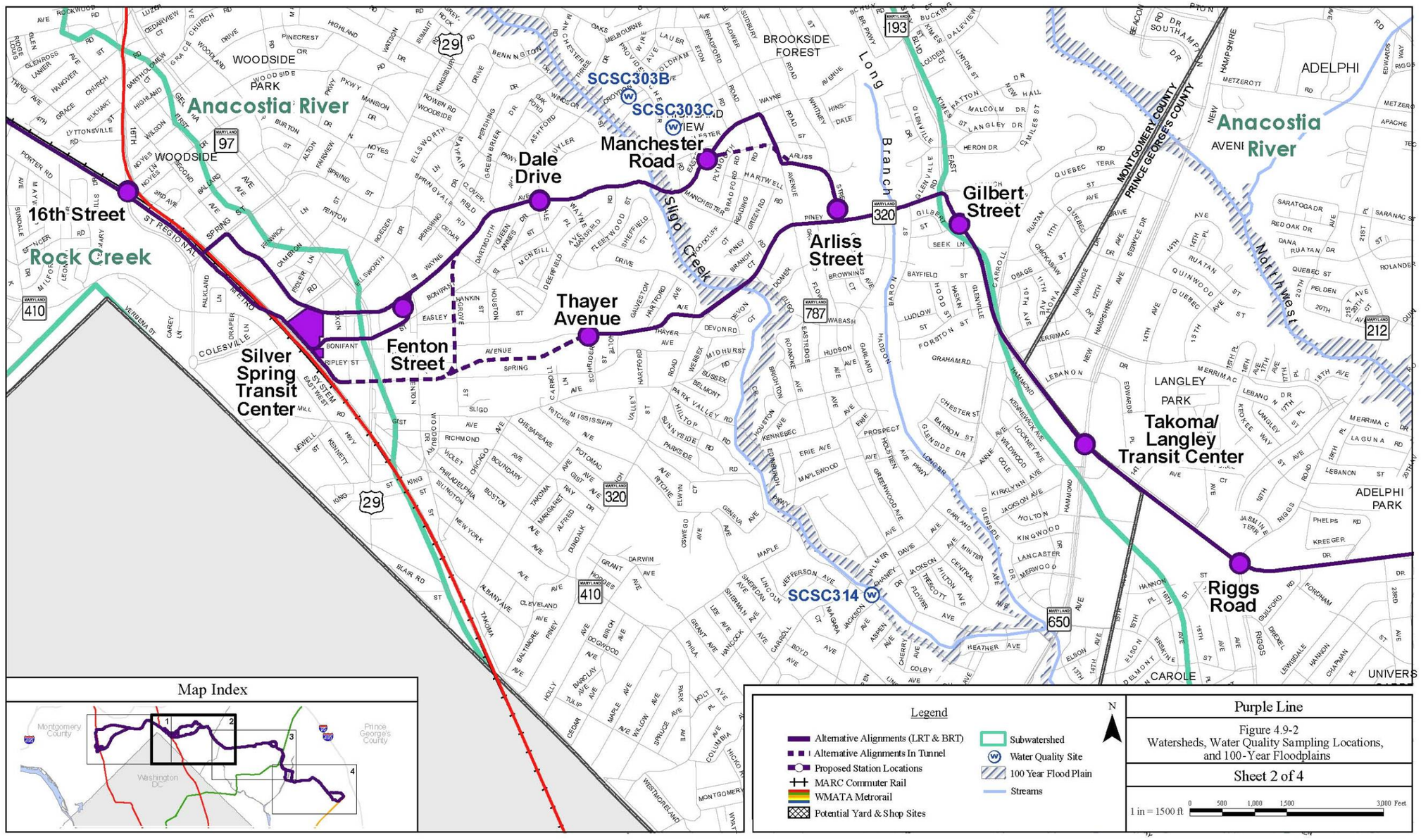


Figure 4.9-2: Watersheds, Water Quality Sampling Locations, and 100 Year Flood Plains (continued)

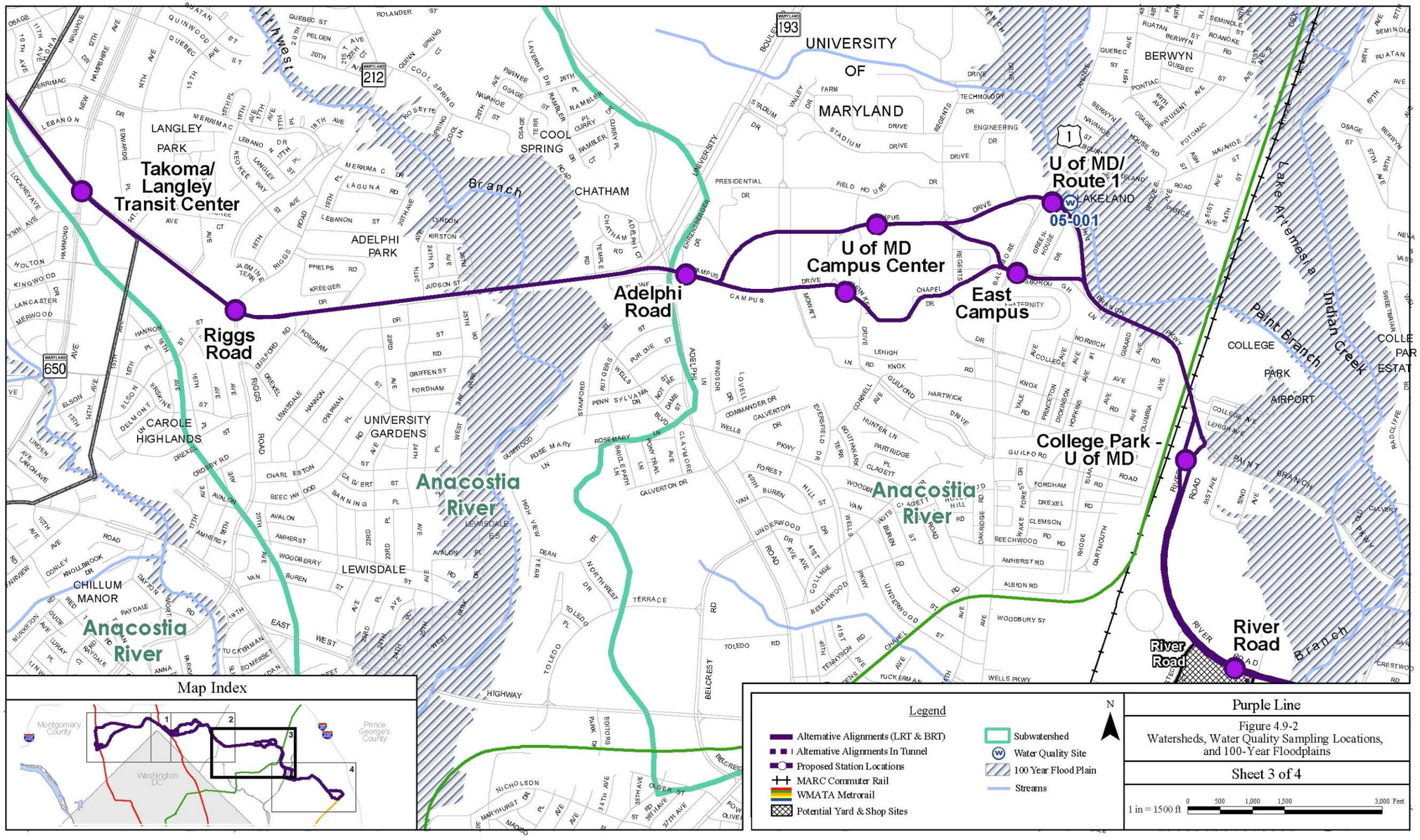
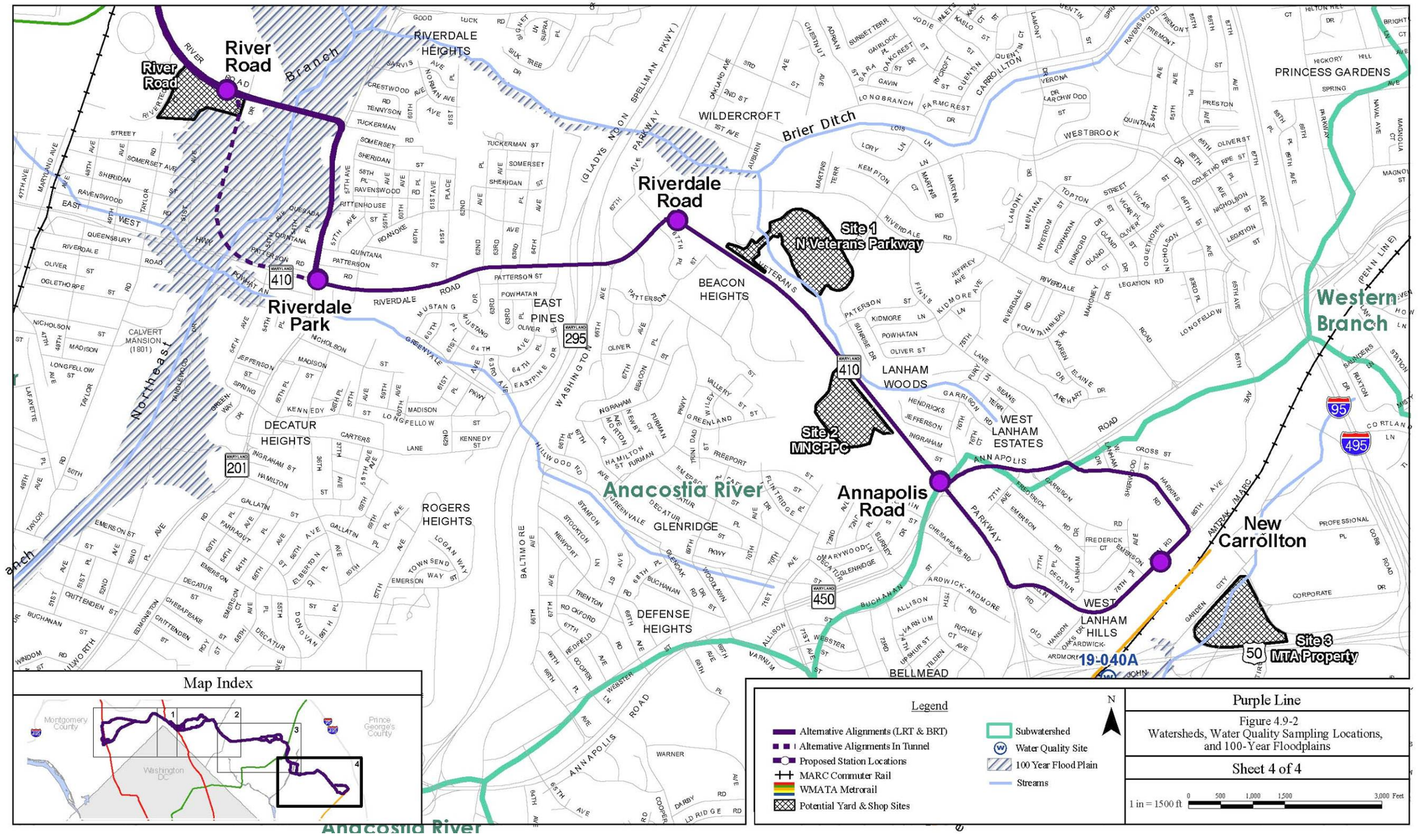


Figure 4.9-2: Watersheds, Water Quality Sampling Locations, and 100 Year Flood Plains (continued)



4.9.4. Rare Threatened and Endangered Species

Based on information provided by DNR, National Marine Fisheries Service, and the U.S. Fish and Wildlife Service, no state or federally known rare, threatened, or endangered species occur within the corridor.

There would be no impacts to rare, threatened, or endangered species from the Purple Line.

4.10. Water Resources

The No Build and TSM Alternatives would not involve any project-related construction or changes to the water resources. Consequently, project-related environmental effects from the No Build and TSM Alternatives are not anticipated, and these alternatives are not included in the detailed discussions of environmental effects that follow. All of the Build alternatives would have direct or indirect effects on water resources within the study corridor. Information on existing conditions of each resource and the potential effects of the project on these resources are summarized below. The majority of the impacts are discussed by alternative, which incorporate multiple design options as part of the overall impact analysis for each alternative. Therefore, the impacts represented for each resource by alternative will most likely be lower than this "worst-case" analysis, as redundant impacts from multiple design options are removed once the design for the alternative is refined.

4.10.1. Groundwater and Hydrogeology

An aquifer is a geologic formation, such as fractured rock or coarse sand, which possesses the porosity required to store and transmit water in usable quantities. Based on the information gathered from the U.S. Geological Survey, the Maryland Geological Survey, and the Maryland Department of the Environment (MDE), five main aquifers are located within the project area. Three major aquifers occur west of MD 212 (Riggs Road) within the Piedmont Physiographic Province: crystalline-rock and undifferentiated sedimentary-rock aquifers, aquifers in early Mesozoic basins, and carbonate rock aquifers. Two aquifers, Castle-Hayne Aquia and Potomac, located within the Coastal Plain Physiographic Province, extend from MD 212 to the eastern end of the corridor.

Water from groundwater wells located within the Piedmont and Coastal Plain Provinces are generally suitable for drinking. However, potential sources of iron, manganese, sulfate, and organic compounds found within groundwater samples were significantly elevated above EPA's non-enforceable drinking water regulations. High iron concentrations within drinking water can be attributed to corrosion of steel casings and well fittings, as well as iron-fixing bacteria. The potential sources of organic compound contamination include discharge from rubber and chemical factories, metal refineries, agricultural chemical factories, and wood preserving factories. The Potomac Aquifer of the Coastal Plain Province has also experienced saline water encroachment in several areas due to the ion-exchange reactions that occur in the water that percolates downward through overlying aquifers.

Low and Medium Investment BRT and LRT and the proposed maintenance and storage facility sites are not expected to substantially affect groundwater. These alternatives and the maintenance and storage facilities would mostly be completely constructed on the ground surface and only minor changes to the movements of the shallow groundwater table are likely during grading and construction of the tunnel components of the LRT. Any runoff would be treated in accordance with MDE guidelines for SWM and released to surface waters.

High Investment BRT and LRT could affect groundwater as a result of their tunnel components. Tunneling could intercept groundwater resources in the shallow aquifers of the Piedmont and shallow groundwater table of the Coastal Plain. Tunnel boring in the Piedmont would likely intercept the rock fractures that are typical of this physiographic province, potentially causing a minor change in localized groundwater paths. These minor changes, however, are not expected to affect overall groundwater flows or quantities.

During the more detailed geotechnical investigations that would occur in later phases of the project, a groundwater testing program would be undertaken to identify any potential groundwater or soil contaminants that could be encountered during tunnel construction.

4.10.2. Surface Water Resources/Water Quality

Surface Water Resources

The corridor contains three DNR watersheds: Potomac River Montgomery County, Rock Creek, and the Anacostia River. Within these larger watersheds are six primary subwatersheds: Little Falls, Rock Creek, Sligo Creek, Northwest Branch, Northeast Branch, and Lower Beaverdam Creek, as illustrated in Figure 4.9-2.

A majority of the subwatersheds have been developed with little or no vegetated buffer remaining, especially within the more urbanized watersheds of Little Falls, Sligo Creek, and Lower Beaverdam Creek. The Rock Creek subwatershed is one of the more forested stream systems within the project area and is frequently used as a recreational corridor. All of the project area streams have been channelized to some degree as a result of urbanization of the watershed or for flood control.

Chemical Water Quality

With the exception of a portion of Northwest Branch, all streams within the corridor are classified as Use I-P, which is designated for water contact recreation, protection of aquatic life, and public water supply. Northwest Branch north of MD 410 is designated as Use IV recreational trout waters.

Many streams within project area have *in-situ* water quality averages that were within state water quality standards. Little Falls and Sligo Creek exhibited dissolved oxygen levels below state standards, while pH levels in Northwest Branch were elevated above the standard. The highest conductivity levels were seen in Lower Beaverdam Creek and Little Falls, which is expected given the high urbanization of these two watersheds.

Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids, such as chloride, nitrate, sulfate and phosphate anions (i.e., ions that carry a negative charge) or sodium, magnesium, calcium, iron and aluminum cations (i.e., ions that carry a positive charge).

Total Maximum Daily Loads

A total maximum daily load (TMDL) is an estimate of the maximum amount of a pollutant that a waterbody can absorb without violating ambient water quality standards (MDE 2007). Each state is required to develop a TMDL under Section 303 of the Clean Water Act (CWA) and identify stream segments that are considered impaired for submittal to the U.S. Environmental Protection Agency as part of the TMDL process. These segments are known as water quality limited segments (WQL), and a TMDL must be

developed for each. The state is required to prioritize each waterbody's need for TMDL development.

Watersheds within the project area that will require the development of a TMDL by MDE include Little Falls, the non-tidal portion of Rock Creek, and the non-tidal portion of the Anacostia River watershed, including Sligo Creek, Northwest Branch, Northeast Branch, and Lower Beaverdam Creek. The following impairments require a TMDL within these watersheds: biological conditions, nutrients, sediment impairments, trash and debris, and biochemical impairments.

All of the Build alternatives and maintenance and storage facilities could increase levels of certain contaminants within the affected subwatersheds. These increases are expected to be greatly minimized with the use of approved sediment and erosion-control measures during construction and implementation of stormwater best management practices, as required by MDE. However, some degree of chemical water quality impairment could still occur, especially within the proposed maintenance and storage facilities, exacerbating problems within subwatersheds where contaminant levels are already elevated.

Potential impacts during construction of the Build alternatives include physical disturbances or alterations, accidental spills, and sediment releases that can affect aquatic life. Impacts associated with the Build alternatives and the maintenance and storage facilities following construction are primarily based on the potential for contamination of surface waters by runoff from new impervious surfaces.

Increased impervious surfaces and vehicle use can increase the concentrations of heavy metals in nearby surface waters. The most common heavy metal contaminants are lead, aluminum, iron, cadmium, copper, manganese, titanium, nickel, zinc, and boron. Most of these contaminants are related to gasoline additives and regular roadway maintenance. The greatest concern associated with metals, even at low concentrations, is the long-term accumulation in bottom sediments and animal tissues.

During construction, the potential for water quality impacts would be minimized through strict adherence to MDE-approved sediment and erosion-control plans, which would include best management practices such as super silt fences, straw bales, sediment basins, and other methods to capture potential sediment from exposed soils. Stormwater management (SWM) plans will be designed and approved in compliance with MDE to treat both quantity and quality of stormwater runoff prior to discharge into receiving waters. For Use I surface waters, in-stream work may not be conducted from March 1 through June 15, inclusive, during any year; Use IV surface waters have an in-stream restriction from March 1 through May 31.

Any increases in biological impairment, nutrients, and trash and debris due to construction of the Build alternatives are expected to be minimal overall. Implementation of a Build alternative could affect the sediment load in receiving waters downstream of the project area during construction however; strict adherence to required sediment and erosion-control protocols will reduce the potential for increased sediment loads within the Anacostia River watershed.

4.10.3. Scenic and Wild Rivers

The definition of a Scenic and Wild River, per the National Wild and Scenic River Act (16 U.S.C. §§1271-1287), is a river that possesses outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. The DNR program regulates present and future use and development of the Scenic and Wild River, tributaries, and adjacent land areas to protect their primitive qualities and characteristics, and to protect the water quality of the river.

According to DNR, the Potomac River (only in Montgomery and Frederick Counties) and the Anacostia River and their tributaries are designated as Scenic and Wild Rivers. The tributaries to the Anacostia River and Potomac River that fall under this designation and occur within the corridor are Little Falls, Sligo Creek, Northwest Branch, Northeast Branch, and Lower Beaverdam Creek. Although Rock Creek is a tributary of the Potomac River, it joins the Potomac downstream of the Scenic and Wild River limits; therefore Rock Creek is not considered a Scenic and Wild River.

All of the Build alternatives are anticipated to have minimal impacts to streams designated as scenic and wild because impacts are primarily associated with extensions of existing bridges and culverts to accommodate the Build alternatives rather than new stream crossings. Any impacts to Scenic and Wild Rivers will be evaluated as part of DNR's environmental review process for the project.

4.10.4. Floodplains

U.S. Department of Transportation Order 5650.2, titled "Floodplain Management and Protection," prescribes policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain effects. Using data from the Federal Emergency Management Agency, the approximate locations of 100-year floodplains in the corridor were mapped and are shown in Figure 4.9-2. The following streams within the project area have associated 100-year floodplains: Coquelin Run, Rock Creek, Sligo Creek, Northwest Branch, Paint Branch, Northeast Branch, Brier Ditch, and Beaverdam Creek.

All of the Build alternatives could affect 100-year floodplains within the Purple Line corridor, as shown in Table 4.10-1. The Medium Investment LRT Alternative would have the greatest effect to 100-year floodplains, at approximately 15.11 acres, while Medium Investment BRT would impact the least amount of area within the 100-year floodplains (approximately 14 acres). The proposed tunnel from River Road to East West Highway under High Investment BRT and LRT would have the greatest impact due to the at-grade and tunnel options that cross the Northeast Branch 100-year floodplain. These impacts could be reduced substantially during later phases of the project when the design is refined, as the footprint in this area assumes an at-grade crossing of the floodplain. The tunnel would most likely be designed as a deep tunnel that would not have a cut and cover option and most likely would not affect the surface of the 100-year floodplain. Therefore, impacts to the 100-year floodplain of Northeast Branch would be expected to decrease. The portals associated with this tunnel would be placed above floodplain elevations on River Road and MD 410 just outside of the 100-year floodplain of Northeast Branch. The second greatest impact under all of the build alternatives would occur within the 100-year floodplain of Northwest Branch.

The placement of substantial amounts of fill in floodplain areas is not anticipated for the at-grade components of the Build alternatives. However, fill may be placed in the 100-year floodplain in areas where the existing road berm may need to be extended to support the placement of aerial structures and the construction of grade separations. No impacts to 100-year floodplains are anticipated with the maintenance and storage facilities. Any construction within the 100-year floodplain will require a Waterway Construction Permit from the MDE.

4.10.5. Waters of the United States, including Wetlands

Waters of the U.S., including wetlands, are regulated under Sections 401 and 404 of the CWA, the Maryland Tidal Wetlands Act, and the State of Maryland Nontidal Wetlands Protection Act.

Information on potential waters of the U.S., including wetlands, within the corridor were gathered from published sources, including the U.S. Fish and Wildlife Service National Wetland Inventory maps and NRCS Soil Surveys for Prince George's and Montgomery Counties. This information was used to verify and supplement a wetland delineation conducted between June and September 2007. All areas within 100 feet of proposed alternatives, station areas, and maintenance and storage facility sites were investigated. Waters of the U.S., including wetlands, were identified and flagged in accordance with the 1987 U.S. Army Corps of Engineers (USACE) *Wetland Delineation Manual* (USACE 1987).

In recent years, ephemeral channels, which carry wet-weather flows were considered jurisdictional based on their connectivity to regulated wetlands and streams. In mid-2006 the U.S. Supreme Court decision in *Rapanos v. U.S.*, 126 S. CT. 2208 (2006) limited the USACE's jurisdiction over ephemeral channels and other wetland features. The agencies will determine jurisdiction over these channels and wetlands features on a case-by-case basis.

In 2003, a Jurisdictional Determination (JD) was received from the USACE for the portion of the project previously studied as the Purple Line West (along the old Georgetown Branch study corridor) between Bethesda and Silver Spring. Because JDs are typically valid for five years, new delineations were not conducted in this portion of the project area. A JD for the entire project, including updated delineations for the Bethesda to Silver Spring area, will be conducted during later phases of the project, after a Locally Preferred Alternative has been selected.

During the field investigation, 56 waters of the U.S., including wetlands, were identified. The locations of these systems are generally shown in Figure 4.10-1.

Impacts to waters of the U.S., including wetlands, from each of the Build alternatives are shown in Table 4.10-1. Effects to nontidal resources may require a Maryland Nontidal Wetlands Permit, a Section 401 Water Quality Certificate, and/or a Waterway Construction Permit from the MDE, as well as a Section 404 permit from the USACE for the discharge of dredged or fill material into waters of the U.S., including wetlands.

Most of the wetlands identified along the alignments fall outside the limits of disturbance for the project. Impacts that do occur are primarily related to streams that cross perpendicular to the project or parallel the roadway and would be affected when existing roads are widened to accommodate the transitway. Impacts to streams that are currently bridged would be temporary, as these existing structures would be extended to accommodate widening. Should new culverts be required in streams, the impacts would be expected to be more permanent.

Medium Investment LRT would have the greatest effect to vegetated wetlands (1.36 acres) within the corridor, while Low Investment BRT would have the least effect (0.98 acre). The affects from Medium Investment LRT are greater than for Low Investment LRT because more of the transitway would be a dedicated guideway, requiring road widening, but less than High Investment LRT, because the high investment alternative includes sections of tunnel and aerial structures with lesser impacts to wetlands. Low Investment BRT, operating mostly on existing roadways in shared lanes, would have the least impacts to wetlands.

Minimal impacts to wetlands (0.03 acre) are anticipated for the Glenridge maintenance and storage facility site, while no impacts to wetlands are anticipated for the Lyttonsville site.

High Investment BRT with the Thayer option could have the greatest effect (5,662 linear feet) to streams within the project area, while Low Investment BRT would have the least effect to streams, with approximately 3,892 linear feet.

Impacts to streams associated with the maintenance and storage facilities are minimal or non-existent.

Short-term construction impacts will be minimized through strict adherence to erosion and sediment-control procedures and MDE SWM regulations. For Use I surface waters, in-stream work may not be conducted between March 1 and June 15, inclusive, during any year, while Use IV surface waters have an in-stream restriction between March 1 and May 31. Long-term impacts to water quality will be minimized to the extent possible through the use of an MDE-approved SWM management plan.

Table 4.10-1: Water Resources and Forest Impacts

Alternative / Maintenance and Storage Site	Wetlands (acres)	Permanent Open Wetlands (acres)	Streams (linear feet)	100-Year Floodplain (acres)	Forests (acres)
Low Investment BRT	0.98	0.20	3,892	14.55	10.70
Medium Investment BRT	1.10	0.20	5,501	13.72	19.89
Medium Investment BRT with Preinkert/Chapel Drive Option	1.09	0.20	5,068	13.46	20.25
High Investment BRT	1.13	0.17	5,717	13.68	21.97
High Investment BRT with Silver Spring/Thayer Avenue Option	1.13	0.17	5,719	13.69	24.62
Low Investment LRT	1.11	0.17	4,222	14.19	17.48
Medium Investment LRT	1.36	0.17	5,628	15.11	18.77
Medium Investment LRT with Preinkert/Chapel Drive Option	1.35	0.17	5,217	14.31	19.13
High Investment LRT	1.31	0.17	5,660	13.80	20.32
High Investment LRT with Silver Spring/Thayer Avenue Option	1.31	0.17	5,662	13.82	22.96
Glenridge Maintenance Facility	0.03	--	35	--	5.30
Lyttonsville Maintenance and Storage Site	--	--	--	--	--

Figure 4.10-1: Wetland and Waterway Locations

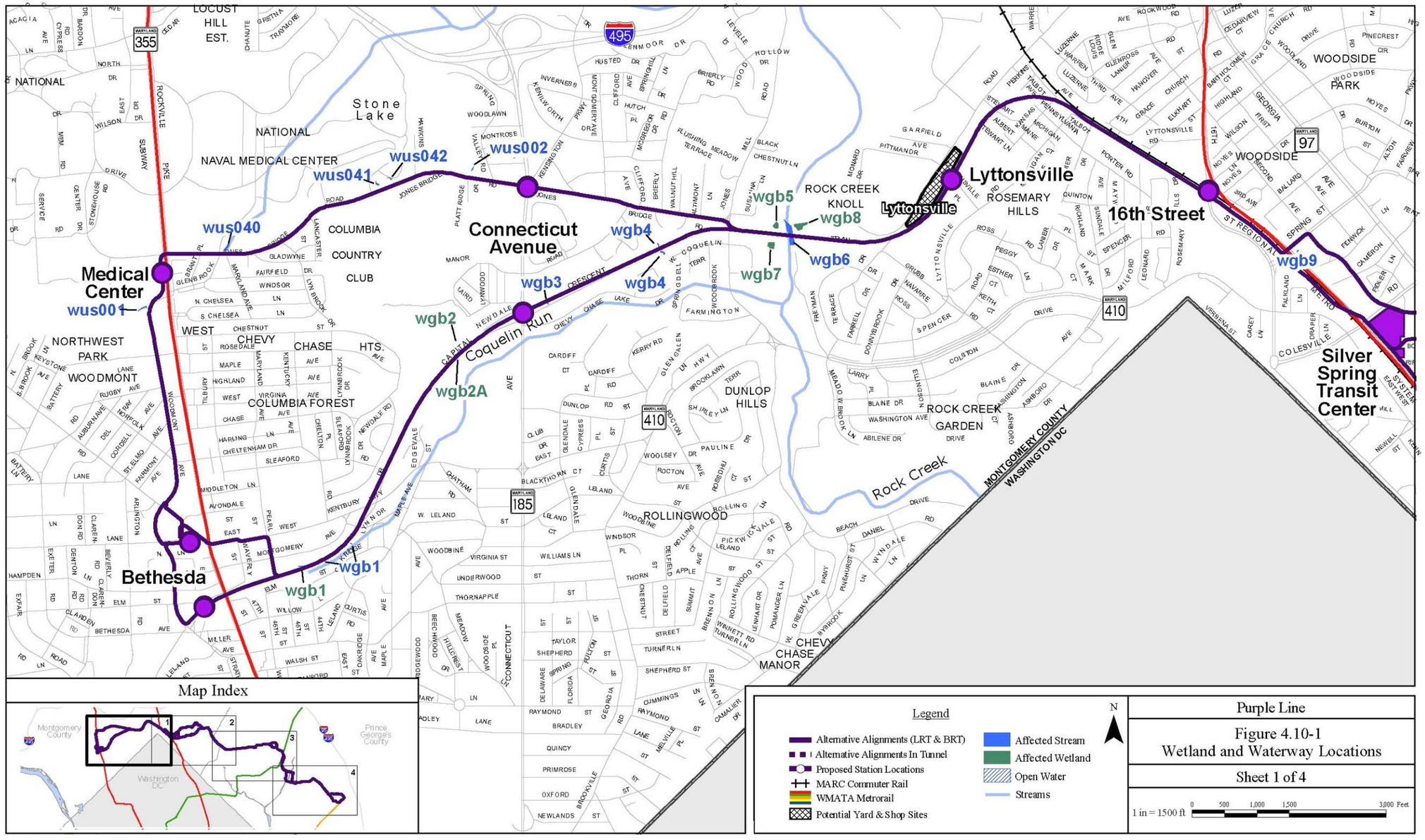


Figure 4.10-1: Wetland and Waterway Locations (continued)

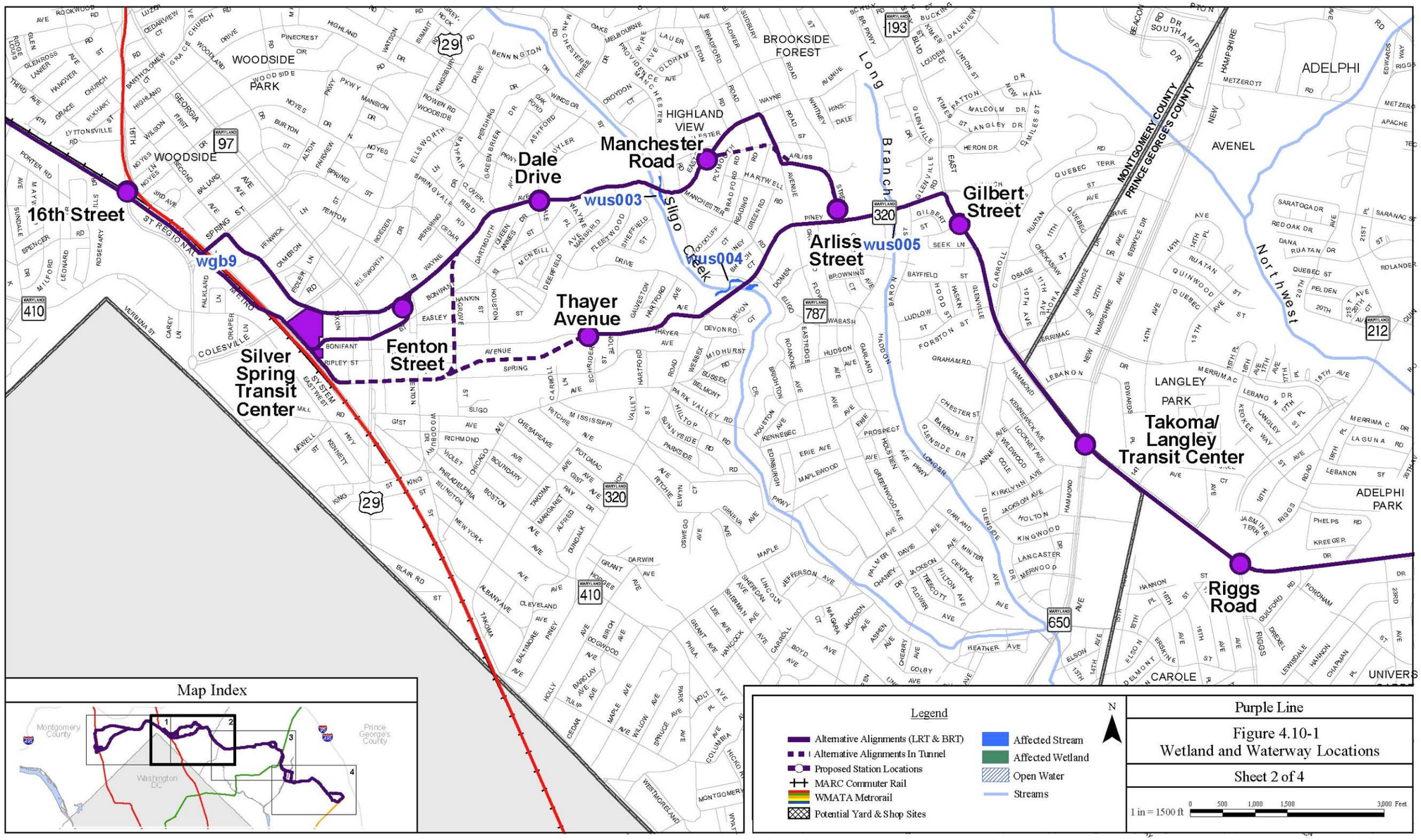


Figure 4.10-1: Wetland and Waterway Locations (continued)

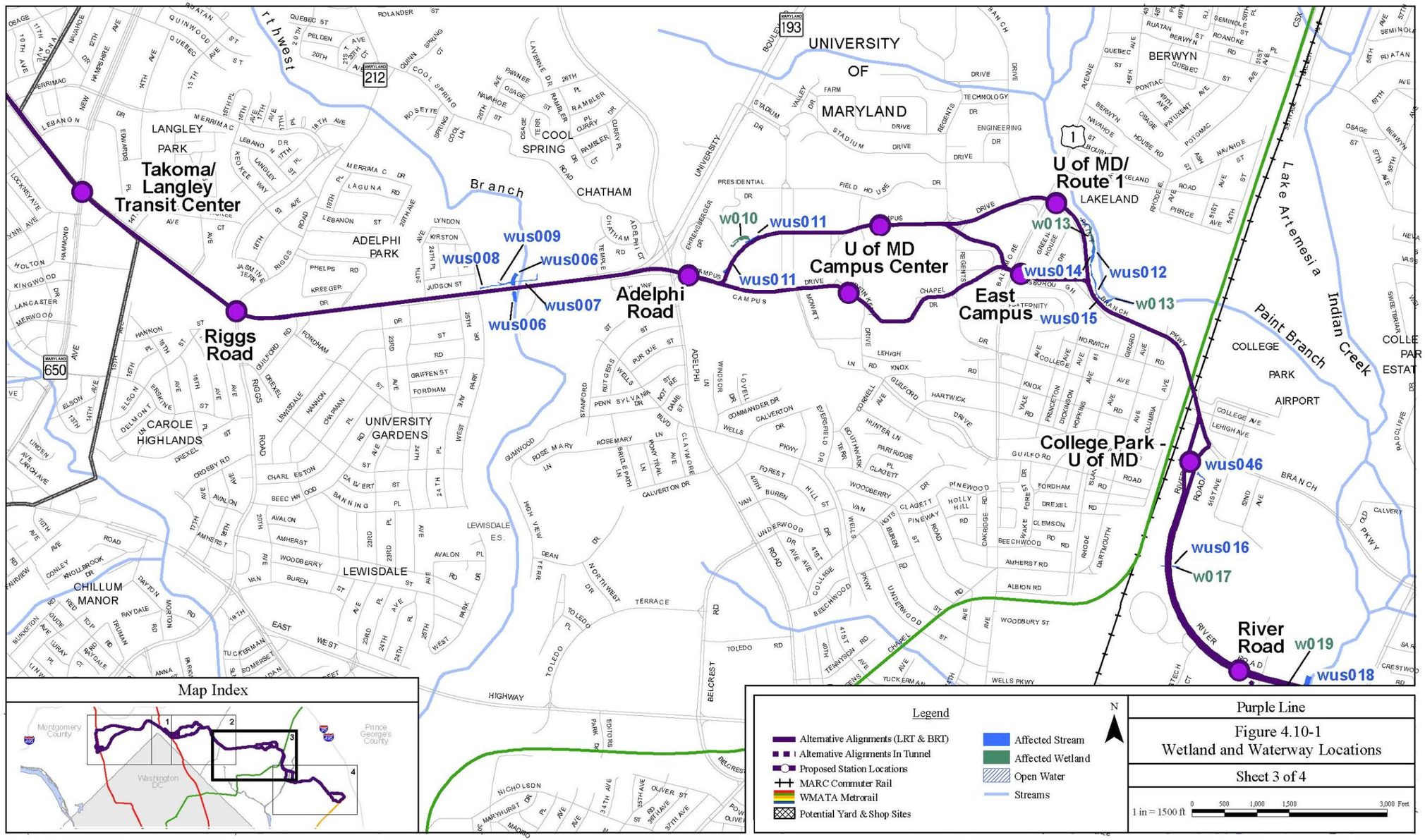
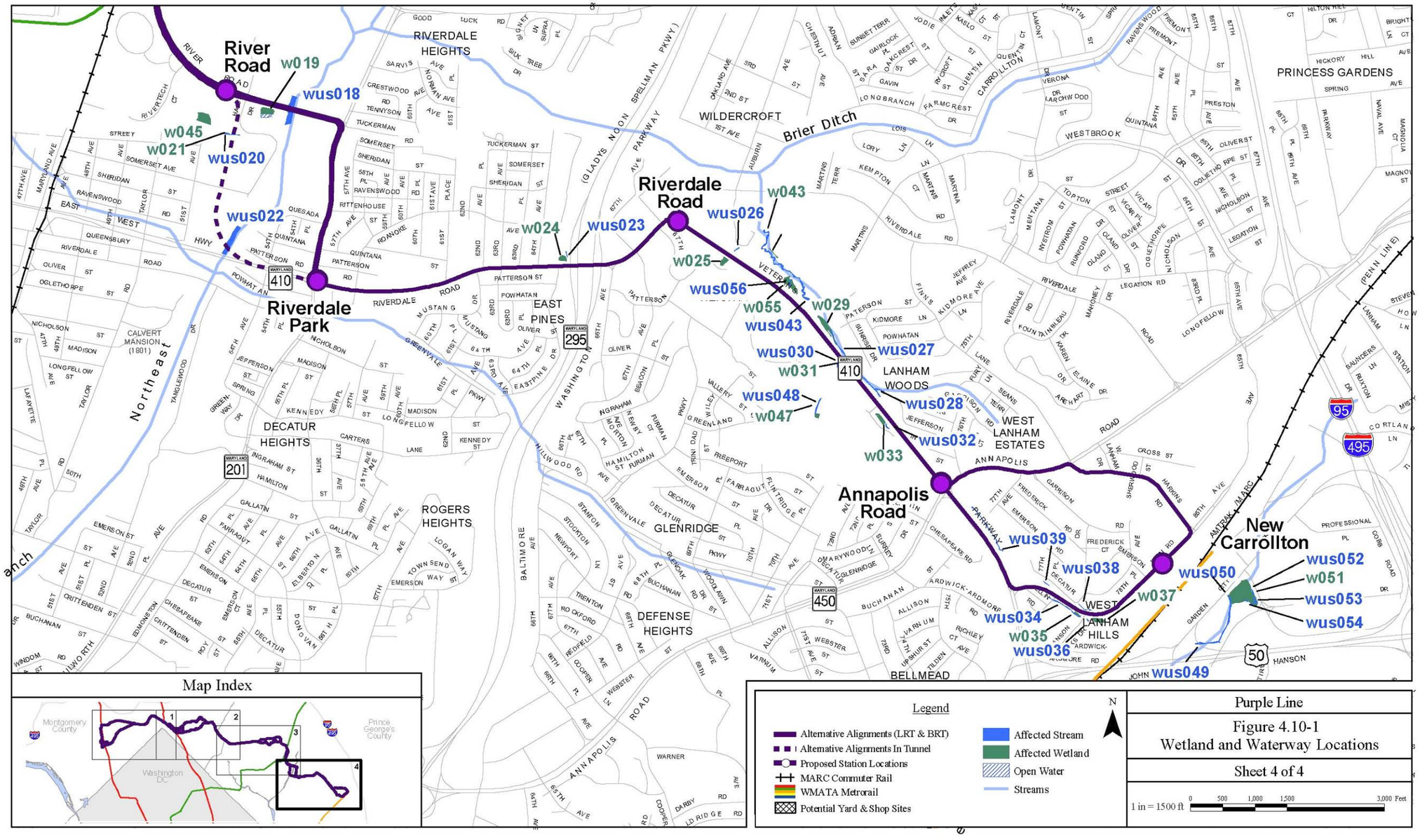


Figure 4.10-1: Wetland and Waterway Locations (continued)



Water Resource Mitigation

Effects to streams or vegetated wetlands from any of the Build alternatives may require a Maryland Nontidal Wetlands Permit, a Section 401 Water Quality Certificate, or a Waterway Construction Permit from the MDE, as well as a Section 404 permit from the USACE for the discharge of dredged or fill material into waters of the U.S., including wetlands. Under the requirements of Section 404 and the Maryland Nontidal Wetland Protection Act, a Joint federal/state permit is required for any impacts to nontidal wetlands resulting from this project. In accordance with federal and state regulations, efforts to avoid and minimize impacts to wetlands and other waters of the U.S. are on-going. Opportunities to avoid, minimize, and mitigate for impacts will continue through later phases of the project when a corridor has been selected and when more detailed design refinements can be employed to further minimize impacts.

Wetland Mitigation

Appropriate and practicable compensatory mitigation is required for unavoidable impacts to wetlands and other waters of the U.S. Compensatory mitigation is being evaluated in accordance with state and federal regulations and guidance. Compensatory mitigation focuses on the replacement of the functions provided by an aquatic resource or wetland, in addition to the acreage affected. Traditionally, mitigation requirements under Section 404 are determined by the ratio of wetland acres replaced to wetland acres lost. Emergent wetlands are typically mitigated on a 1:1 replacement basis, while forested and scrub-shrub wetlands are mitigated on a 2:1 basis. The decision to replace function, acreage or both may be adjusted at the discretion of the USACE or MDE depending on the practicability of the proposed mitigation.

A preliminary mitigation site search was conducted and eight potential mitigation sites were retained for further study. Those sites that are less than the required acreage for mitigation could be used in conjunction with another site to fulfill the mitigation requirements. In later phases of the project, detailed studies and on-site investigations will need to be conducted to determine which sites are suitable to move forward in the mitigation process.

Stream Mitigation

The USACE typically requires mitigation for waterway impacts on a project-specific basis. The agencies target compensatory stream mitigation projects to replace stream functions, when feasible. In addition to stream channel improvements, mitigation measures for waterway impacts consider the size, stream order, and location of the stream to determine appropriate stream mitigation. Other mitigation measures, such as removal of fish blockages, riparian buffer enhancements, and water quality improvements, may be used at the agencies' discretion.

Following a preliminary site search, 12 potential stream restoration sites were retained for further review and detailed studies. Refer to the *Natural Resources Technical Report* for additional information regarding the site search process and these stream restoration sites in particular.

4.11. Topography, Geology, and Soils

The No Build and TSM Alternatives would not involve any project-related construction or changes to the topography, geology, and soils. Consequently, project-related environmental effects from the No Build and TSM Alternatives are not anticipated, and this alternative is not included in the detailed discussions of environmental effects that follow. All of the Build alternatives would have direct or indirect effects on topography, geology, and soils within the study corridor. Information on existing conditions of each resource and the potential effects of the project on these resources are summarized below. The majority of the impacts are discussed by alternative, which incorporate some design options as part of the overall impact analysis for each alternative. Therefore, the impacts represented for each resource by alternative will most likely be lower than this "worst-case" analysis, as redundant impacts from the design options are removed once the design for the alternative is refined.

4.11.1. Topography

Much of the topographic landscape has been manipulated for development, such as filling of historic wetlands along streams, raised berms for highways, and grading of topographic relief for the urban street grid. The highest elevations occur mainly within the western portion of the corridor, and the lowest elevations occur near the tributaries of the Anacostia River.

Topographic impacts from each of the Build alternatives and their associated design options are expected to be minimal. The Build alternatives will either maintain the existing topography, as most of the alternatives occur within the median of the roadway, or will require grading that would amount to a relatively small incremental change to the existing topography. Changes to topography would occur primarily from reconfiguring existing roadways to support aerial crossings and tunnel options; widening the existing road berm to accommodate the Purple Line.

Low Investment BRT would have the fewest constructed elements, making it the Build alternative that would have the least effect on topography. High Investment BRT and LRT would have the greatest effect to topography due to the tunnel components, which would be either cut and cover or deep tunnel that would be constructed using underground boring machines.

Minimal grading would be required for the Lyttonsville maintenance and storage site; but the Glenridge facility site is located on a steep hillside that would require extensive grading and fill to accommodate the infrastructure of a maintenance and storage facility. Proper sediment and erosion-control measures would be in place during construction, to reduce further alteration of natural drainage patterns and the hydrology of adjacent wetlands and streams.

4.11.2. Geology

The corridor is underlain by the Piedmont Physiographic Province in the western portion of the corridor. The Piedmont extends from the western terminus to just east of US 29, where it transitions to the Coastal Plain Province. The transition between the Coastal Plain and Piedmont is known as the fall zone, which crosses the corridor from southwest to northeast, immediately east of US 29. The Piedmont Province consists of hard, crystalline igneous and metamorphic rocks. Coastal Plain geology is characterized by unconsolidated sediments that include clay, gravel, sand, and silt.

The western portion of the corridor crosses the Lower Pelitic Schist Formation, as shown in Figure 4.11-1. A thin band of Kensington Quartz Diorite runs perpendicular through the corridor, primarily within Rock Creek Stream Valley Park in the Bethesda/Chevy Chase segment. The Boulder Gneiss Formation, which was formerly known as the Sykesville and Laurel Formations, comprises a large portion of the Silver Spring segment.

The Coastal Plain Province portion of the corridor consists of two formations, the Potomac Group and the Lowland Deposits, as shown in Figure 4.11-1. The Potomac Group comprises a majority of the corridor. The Lowland Deposits

Figure 4.11-1: Geologic Areas

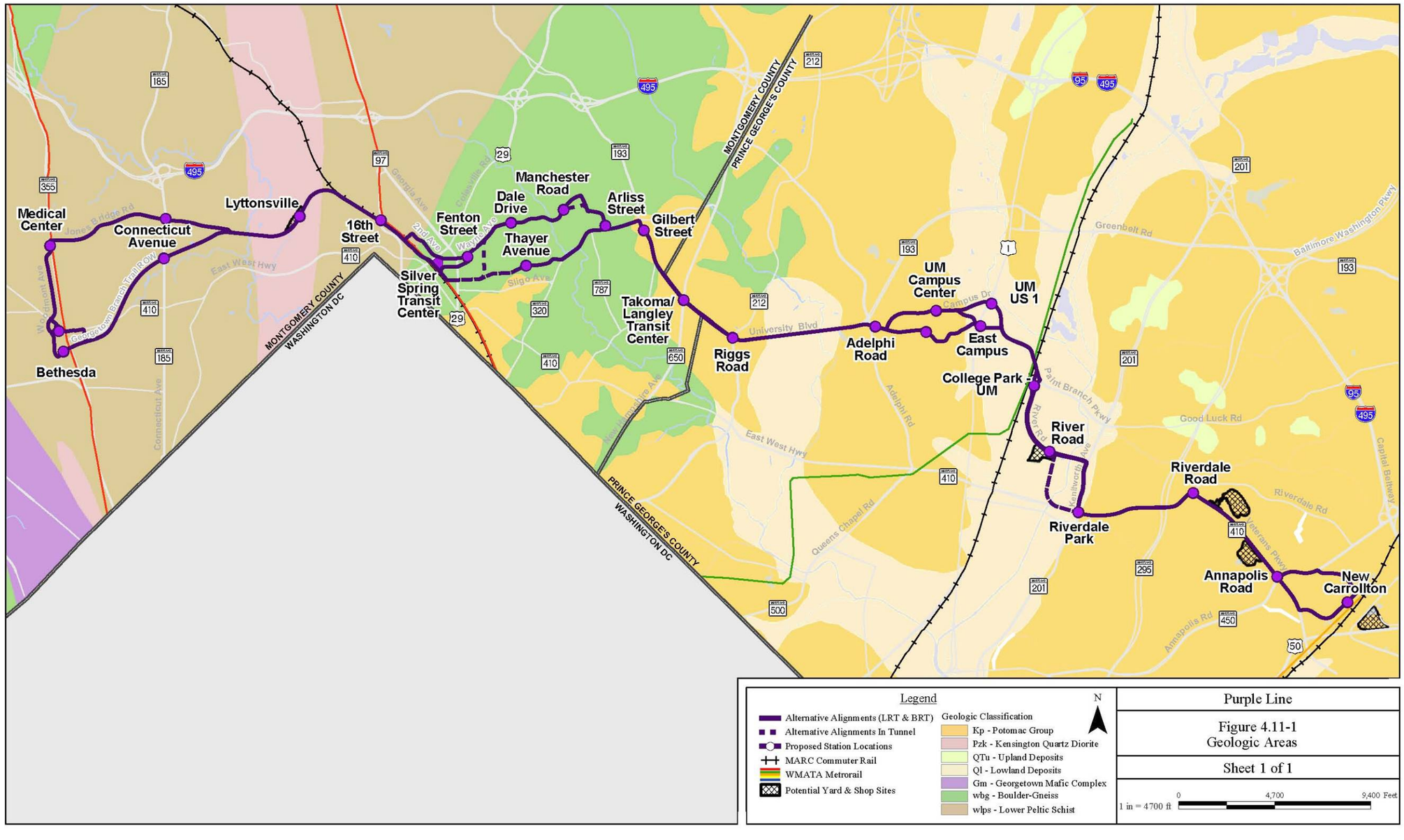


Figure 4.11-2: Soil Associations

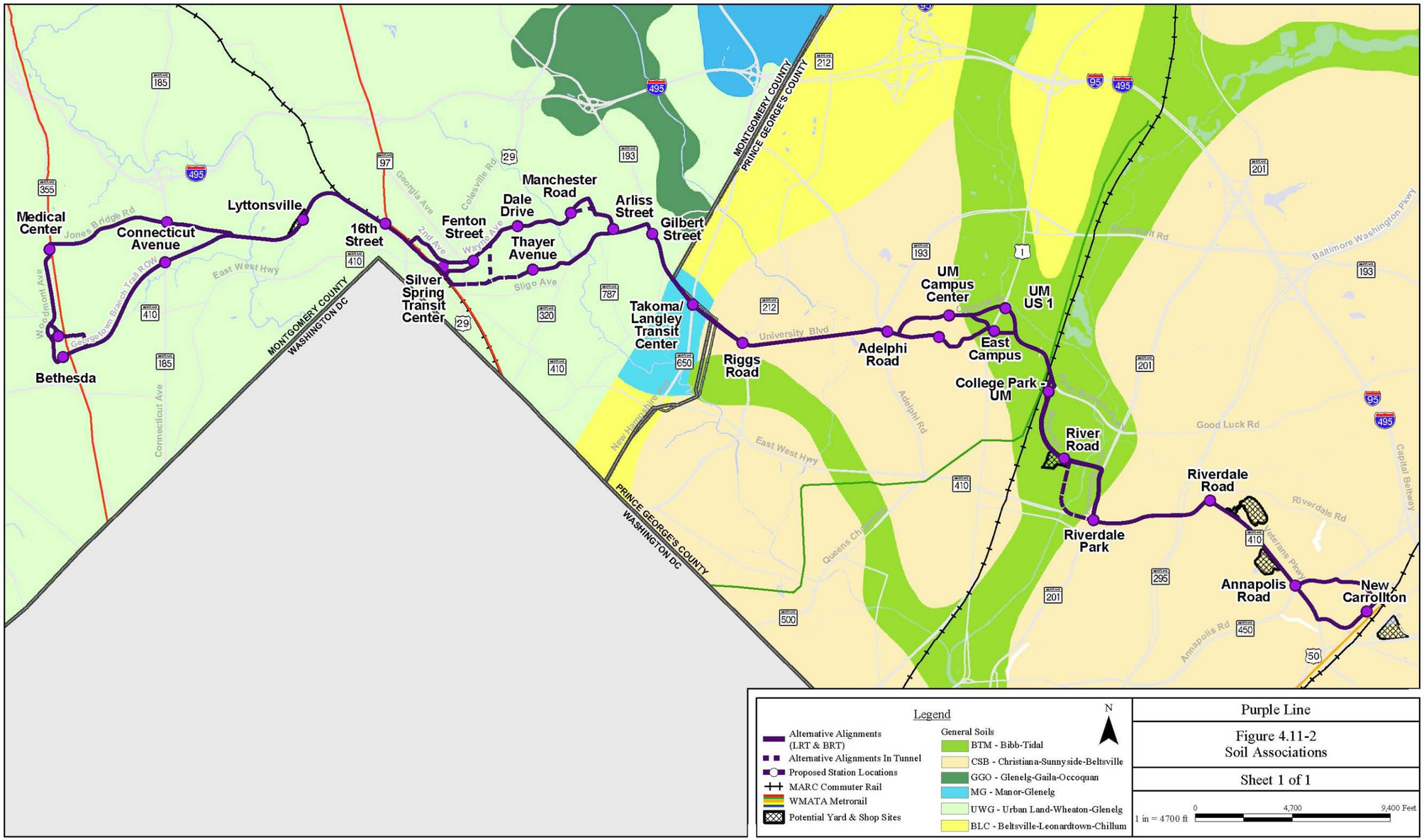


Figure 4.11-3: Highly Erodible Soils

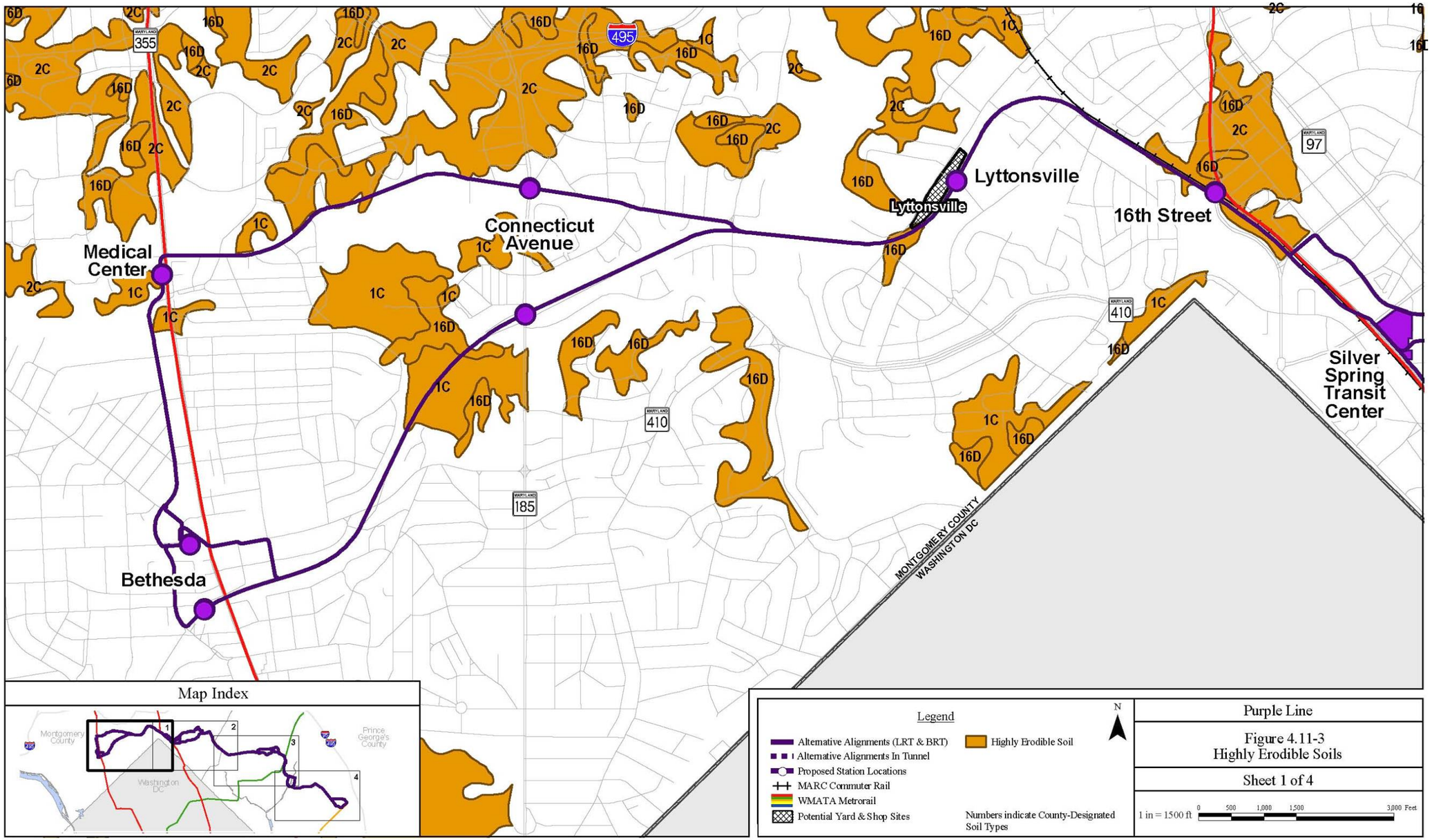


Figure 4.11-3: Highly Erodible Soils (continued)

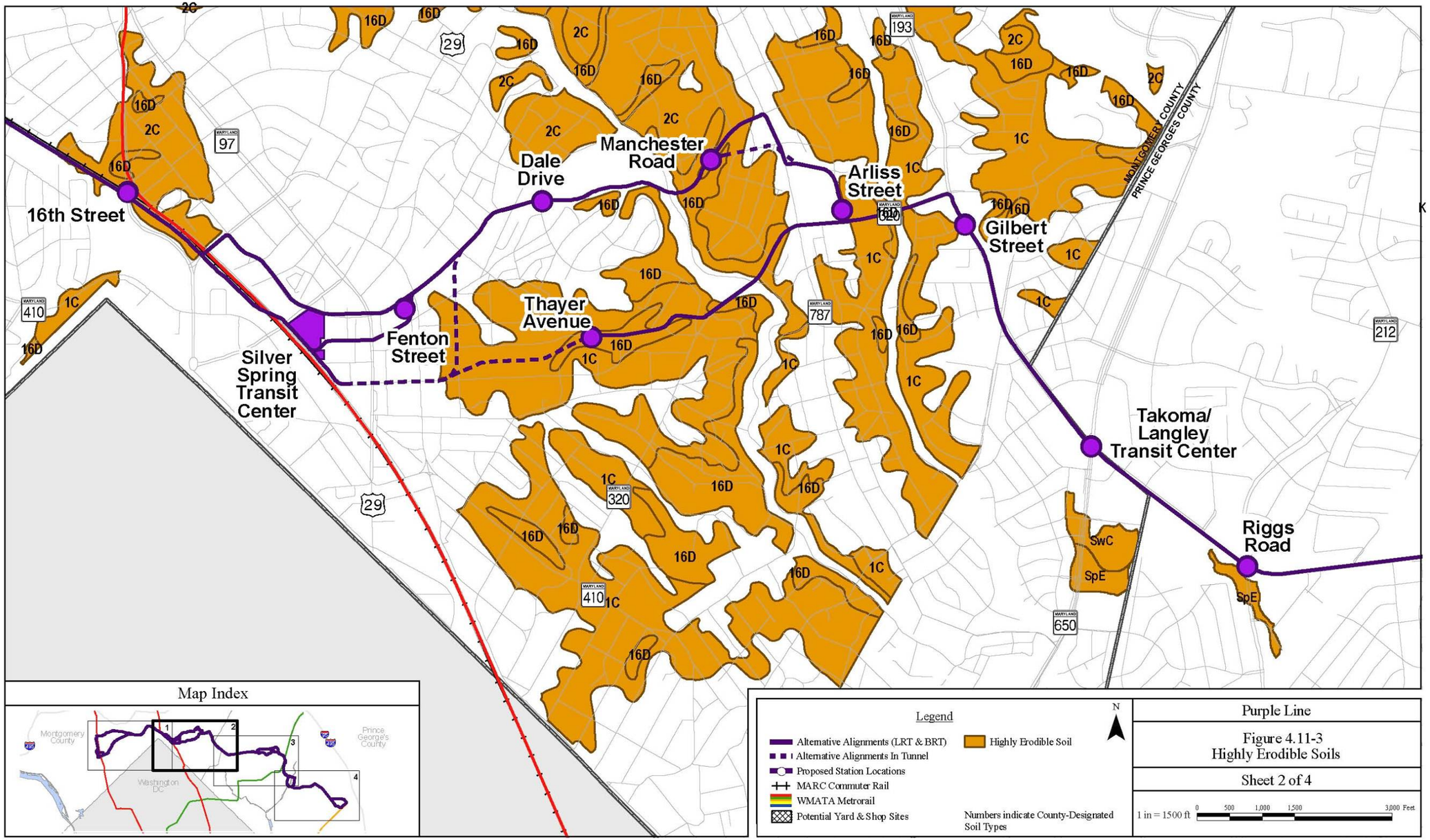


Figure 4.11-3: Highly Erodible Soils (continued)

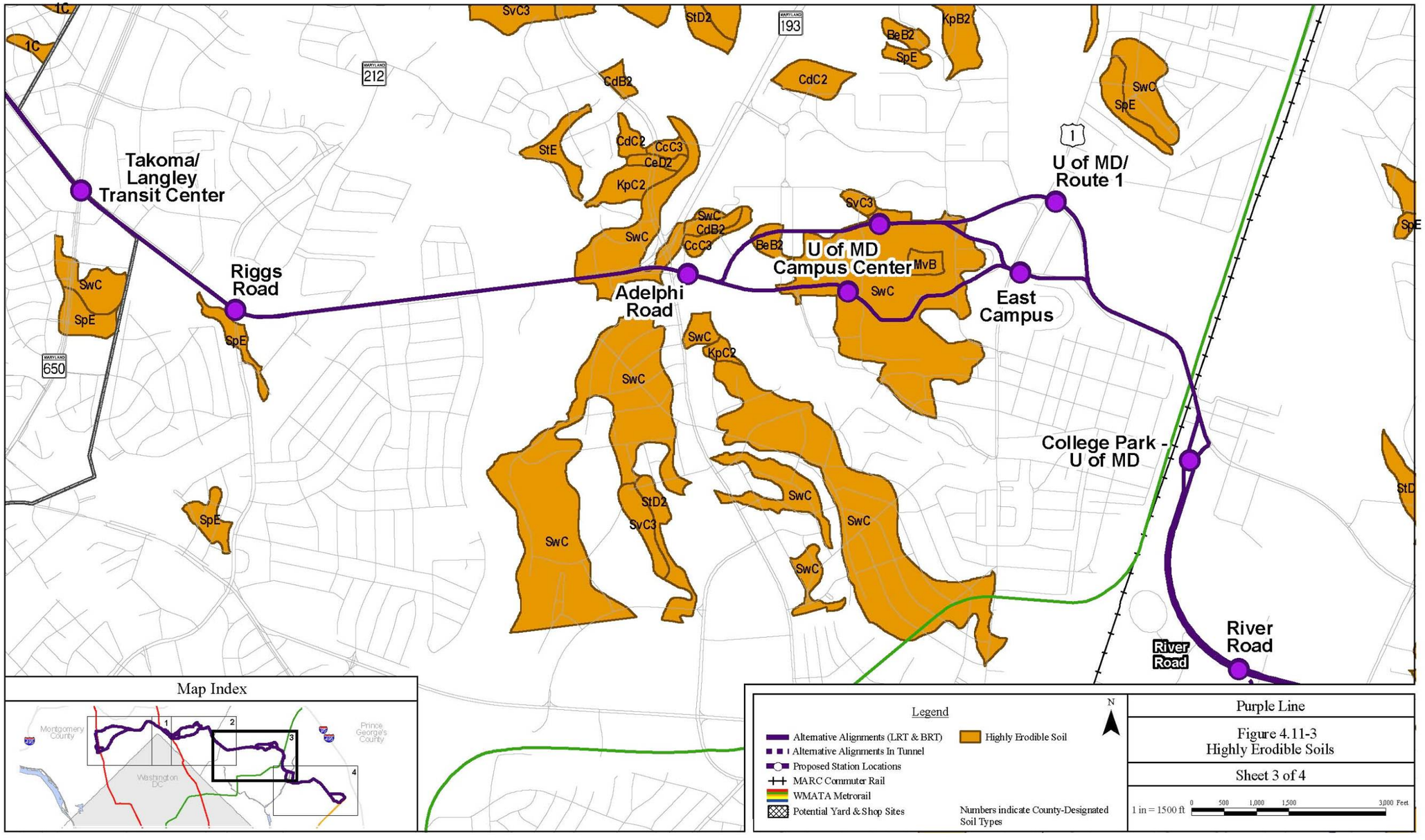


Figure 4.11-3: Highly Erodible Soils (continued)

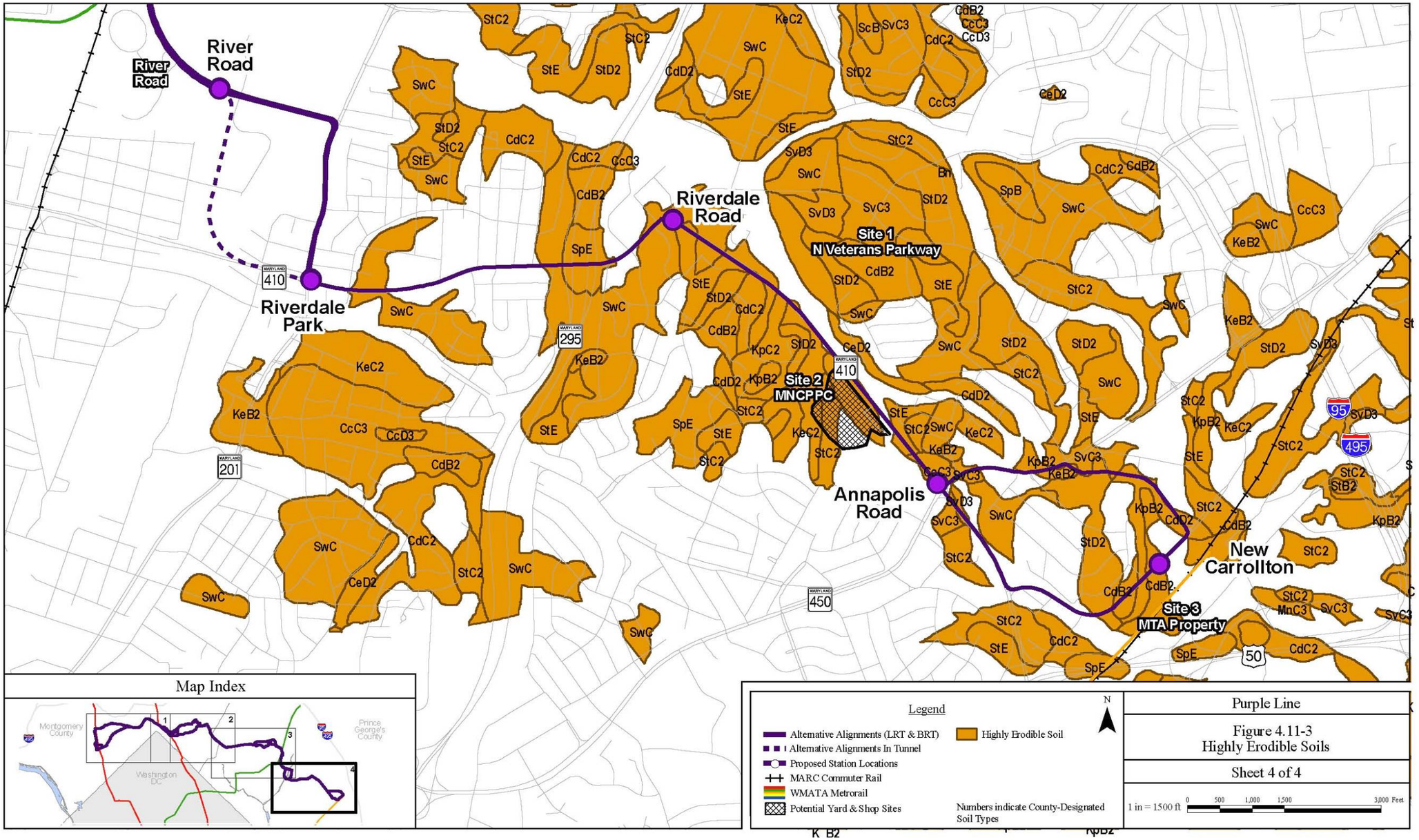


Table 4.11-1: Soil Impacts

Alternative	Highly Erodible Soil (acres)
Low Investment BRT	70.83
Medium Investment BRT	76.20
Medium Investment BRT with Preinkert/Chapel Drive Option	78.83
High Investment BRT	78.41
High Investment BRT with Silver Spring/Thayer Avenue Option	86.60
Low Investment LRT	76.39
Medium Investment LRT	72.76
Medium Investment LRT with Preinkert/Chapel Drive Option	75.26
High Investment LRT	75.36
High Investment LRT with Silver Spring/Thayer Avenue Option	83.45

occur along the Anacostia River and smaller project-area streams, including Sligo Creek, Northwest Branch, Paint Branch, and Indian Creek.

Effects on geology would be greatest for High Investment BRT and LRT, which include tunnel options. Alternatives and Maintenance and Storage facilities that involve only surface construction would have little or no effect on this resource. All of the tunnel options could change the geologic resources in the corridor, although these changes would be limited to the tunnel section itself, where rock or Coastal Plain deposits would be bored and removed for construction of the tunnel.

Detailed geotechnical investigations will be undertaken in later phases of the project to determine the specific nature of the geologic formations within the tunnel sections. This information will be used for design of the tunnel sections and for development of construction techniques tailored to the specific geologic conditions in the corridor.

4.11.3. Soils

Based on the soil information obtained from the *U.S. Department of Agriculture (USDA)–Natural Resources Conservation Service (NRCS) Montgomery County Soil Survey (*USDA 1995) and the *Prince George's County Soil Survey* (USDA 1967), six soil associations occur within the corridor, as illustrated in Figure 4.11-2.

Montgomery County contains two of these soil associations: the Urban Land-Wheaton-Glenelg association and the Glenelg-Gaila-Occoquan association. Prince George's County contains the remaining four soil associations: the Manor-Glenelg association, the Beltsville-Leonardtown-Chillum association, the Christiana-Sunnyside-Beltsville association, and the Bibb-Tidal association.

Within these broad associations in the corridor, there are 70 soil mapping units. Montgomery County has 13 soil mapping units, and Prince George's County has 57. Refer to the *Natural Resources Technical Report* for more detailed information regarding the soil mapping units and their significant characteristics.

Highly Erodible Land

Information on highly erodible land (HEL) in the corridor was obtained from the NRCS HEL list for Montgomery and Prince George's Counties.

In the corridor, 24 soil types are classified as highly erodible land, as illustrated in Figure 4.11-3. Highly erodible land is susceptible to the erosive forces of wind and water.

The High Investment BRT Alternative with the Thayer option would have the highest potential impact (86.60 acres) to highly erodible soils (Table 4.11-1) and Low Investment BRT would have the least amount of impact (70.83 acres). The Glenridge facility would impact 12.10 acres of highly erodible soils. If precautions are not taken construction, highly erodible soils can be washed into nearby streams, resulting in stream channel destabilization, increased flooding, and loss of aquatic habitat. Implementing sediment and erosion-control measures, such as vegetative stabilization, silt fences, and sediment traps, can minimize potential soil-erosion impacts.

Prime Farmland Soils and Soils of Statewide Importance

The county lists for prime farmland and soils of statewide importance were obtained from the *USDA-NRCS Soil Data Mart* (USDA 2007).

Prime farmland is soil that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Typically, these lands do not flood frequently or are protected from flooding. They receive an adequate water supply from irrigation or precipitation and are permeable to water and air.

Soils of Statewide Importance include land, in addition to prime farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. In general, additional farmlands Soils of Statewide Importance include those that are nearly Prime Farmland and that produce high yields of cash crops or livestock feed when treated and managed according to conventional farming methods. Prime Farmland Soils and Soils of Statewide Importance within the project area are listed in the *Natural Resources Technical Report*.

Effects

Because of the urbanized nature of the corridor, the majority of soils potentially affected by the project have already been disturbed, manipulated, or covered by development. Additional soil disturbances would occur for all of the Build alternatives and Maintenance and Storage facilities, due to grading. Other potential impacts that could occur with any of the Build alternatives include changes to drainage patterns within or adjacent to the right-of-way. However, these effects should be minimal and will be reduced by required SWM facilities.

Soil types and their limitations for construction will be evaluated in detail during later phases of the project, should a Build alternative be selected. Detailed geotechnical investigations will be conducted to assess soil characteristics along the selected alternative, so that construction techniques and environmental safeguards can be developed to address any limitations. Soil stabilization techniques will be used in work areas, both during and after construction, to prevent potential sedimentation of nearby waterways and minimize other potential soil disturbance effects. Sediment and erosion controls and SWM facilities will be implemented in the project area in accordance with the Maryland Department of Environment (MDE) *2000 Maryland Stormwater Design Manual, Volumes I & II*.

Those areas within the corridor designated as potential Prime Farmland Soils and Soils of

Statewide Importance are already developed. When developed, these soils are no longer considered prime farmland. Therefore, effects to Prime Farmland and coordination under the Farmland Protection Policy Act are not anticipated.

4.12. Hazardous Materials: Initial Site Assessment

An Initial Site Assessment (ISA) of the Purple Line corridor was conducted to identify, to the extent feasible, potential areas of hazardous waste concern or known recognized environmental conditions (RECs) on properties that would be impacted or encroached upon by the Purple Line alternatives. A REC is defined as the presence or likely presence of any hazardous substance or petroleum product on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property (American Society for Testing and Materials, (ASTM), 2005). The assessment was conducted in accordance with applicable portions of the ASTM *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, Designation: E 1527-05. It should be noted that the ISA was intended to support a planning study of the Purple Line corridor and was **not** intended to directly facilitate any potential future property, easement, or right-of-way acquisitions. Pending determination of a preferred alternative and further design, additional site-specific assessments may be needed. For more detailed information see the *Hazardous Materials Technical Report: Initial Site Assessment*.

4.12.1. ISA Methodology

The following structured process was used to identify potential hazardous waste issues associated with the Purple Line. Steps 1 through 4 are described. The ISA steps are as follows:

Step 1 — Determine a study-area boundary appropriate to hazardous waste issues. In developing the appropriate ISA study area boundary, two primary objectives were considered: (1) the ISA study area had to incorporate the worst-case scenario limits of disturbance (LOD) for all the alternatives, and (2) preferably, after meeting Objective 1, the study area would be appropriately sized to allow for an inclusive, detailed evaluation. All properties overlapping the LOD were included in the study area. The resulting boundary included all properties directly abutting the alignment and those that were in close proximity.

Additionally, two areas were investigated for use as potential maintenance and storage facilities; the existing Montgomery County Ride On bus maintenance facility at Lyttonsville, and the M-NCPPC Glenridge Park Maintenance Facility on Veterans Parkway.

Step 2 — Research the environmental setting within the ISA study area to characterize the topography, surface water, soils, wetlands, and floodplains. The environmental setting of an area can affect the transport and storage of hazardous waste contaminants. The environmental setting is defined by the general characteristics of topography, surface water, geology, soils, wetlands, and floodplains.

Step 3 — Collect information pertaining to past releases of hazardous substances or petroleum products as well as previous land uses and activities within the ISA study area. Information collection efforts included a thorough review of regulatory agency records, a review of historical source information, and site reconnaissance. The site reconnaissance was conducted to observe previously documented properties and to identify observable evidence of existing or undocumented contamination.

Land uses that might indicate environmental risks include businesses that use, transport, or store petroleum products (oil, gas, grease for lubricating machinery), solvents, paints, electrical equipment that may have used PCBs, explosives, and glues. During this review, particular attention was paid to businesses or properties that were “filling” stations, auto sales and service, auto painting (or any painting), coal yards, dry cleaners, electronics manufacturers (solvents), electrical substations, armories, laboratories, telephone companies (companies that may maintain fleets of vehicles), post offices, fire departments, maintenance buildings (storage of fuel for vehicles and mowers), and woodworking facilities (solvents).

Step 4 — Determine the potential for the identified properties to contain hazardous material concerns and rank the properties based on that potential.

Step 5 — Evaluate the locations where potential hazardous waste concerns or known RECs could affect or be affected by the Purple Line alternatives.

4.12.2. Site Ranking

Each site, or property, identified to be of concern (i.e., with a known or potential REC), was ranked in terms of its potential to impact, or be impacted by, the Purple Line. Using the criteria listed in Table 4.12-1, each property was assigned a numeric ranking of 1 through 6. Properties assigned the ranking of 1 were deemed to have a relatively high potential for RECs, contamination or hazardous waste, or health concerns based on the data evaluated. Some properties that are listed on environmental regulatory databases, but could not be otherwise classified due to insufficient data, were given a ranking of 2 and are conservatively presumed to warrant further inquiry and/or investigation. The rankings of 1 and 2 are generally assigned to properties of significant concern located within or immediately adjacent to the LOD. Properties assigned a ranking of 3 or 4 are considered to have a moderate potential for concern, and properties assigned a ranking of 5 or 6 are considered to have a relatively low potential for concern.

4.12.3. Summary of Impacts to Hazardous Material Sites

The ISA identified 240 properties of potential concern. Of the 240 properties identified, 107 were determined to have a relatively high potential for concern. The identified properties are summarized, by segment, in Table 4.12-2. Properties were classified as having a high potential for concern if they had a definitive REC or if they were listed on regulatory databases but could not be otherwise classified due to insufficient information. Such properties include automobile service stations that store and handle petroleum products and solvents. The ISA was based on information available during the preparation of the *Hazardous Materials Technical Report: Initial Site Assessment* and does not warrant against future operations or conditions, nor does it warrant against operations or conditions present of a type or at a location not investigated.

Potential impacts to sites ranking 1 or 2 may result from displacements or partial takings for right-of-ways are shown in Table 4.12-3.

Table 4.12-1: Site Ranking Based on Potential for Contamination

Site Rank	Site Observations or Conditions
1 – High	▪ Industrial facilities ▪ Gasoline stations ▪ Auto repair facilities ▪ Paint manufacturing facilities ▪ Above-ground storage tanks with a large amount of staining ▪ USTs containing gasoline, jet fuel, kerosene fuel, waste oil or solvents ▪ Landfills ▪ Remediation systems in place ▪ Pits and lagoons ▪ Dry cleaners ▪ PCB transformers with major stains ▪ Surface dumps with drums or other hazardous materials
2 – Listed Sites	▪ Regulatory database listed sites that could not be otherwise classified due to insufficient data or MDE regulatory information.
3 – Medium/High	▪ USTs containing materials other than those listed above ▪ Surface dump with empty drums or other materials of concern ▪ Mounds ▪ Above-ground storage tanks with several medium stains ▪ Suspect PCB containing transformers with minor stains
4 – Medium	▪ Small amounts of surface staining ▪ Slightly discolored surface water ▪ Suspect PCB containing transformers, no staining ▪ Stressed vegetation ▪ Unmarked transformers ▪ Large surface dumps containing household wastes ▪ Above-ground storage tanks with a few small stains or no staining, but questionable integrity ▪ Hazardous materials storage sites
5 – Medium/Low	▪ All regulatory databases identified facilities that are not located within the LOD and that are not expected to result in impacts to the site at this time.
6 – Low	▪ Small surface dumps containing household wastes ▪ Above-ground storage tanks (relatively new) with no staining or evidence of poor structural integrity ▪ Septic systems ▪ Auto repair/vehicle maintenance facilities on non-adjacent properties that are not expected to impact the project site.

4.12.4. Future Hazardous Material Investigations

Based on the results of the ISA, conceptual planning of the Purple Line should strive to avoid sites or properties with a high potential for concern, to the extent practicable. If unavoidable, design plans may need to account for remediation of the site concerns.

If right-of-way acquisition is required for properties with a high potential for concern, a Phase II Environmental Site Assessment (ESA) should be conducted following ASTM guidance and in coordination with the MDE prior to acquisition, unless the property can be classified otherwise. A Phase II ESA may include chemical analysis of soil, groundwater, surface water, and sediments within a potentially contaminated site. Geophysical studies, including soil borings, installation of monitoring wells, and digging of test pits, may also be required.

If, during project planning or construction, inactive water wells or USTs decommissioned in-place are encountered, they should be properly closed and removed. Inactive water wells should be closed in accordance with state and local requirements so that they do not provide a conduit for possible contamination of groundwater. If a decommissioned UST is encountered at any point, it should be removed and confirmation soil sampling should be conducted to determine if there has been a release of petroleum.

Table 4.12-2: Number of Sites of Rank 1 or 2 that could be Impacted

Alternative	Number of Sites
Low Investment BRT	47
Medium Investment BRT	50
High Investment BRT	54
Low Investment LRT	56
Medium Investment LRT	47
High Investment LRT	51

Table 4.12-3: Summary of Sites of Potential Concern

Segment	Sites of Potential Concern	Relatively High Potential for Concern (Rank of 1 or 2)
Bethesda/Chevy Chase	88	33
Silver Spring	68	29
University Boulevard	28	18
UM/College Park	8	2
Riverdale Park	31	12
New Carrollton	17	13
Total	**240**	**107**

If site buildings are to be demolished or renovated, asbestos and lead-based paint surveys should be conducted by a qualified contractor.

Depending on the specific site concerns and needs of the Purple Line, construction of the Purple Line may also afford the opportunity for cleaning-up particular known hazardous waste issues within the corridor.

4.13. Safety and Security

This section examines the effects on safety and security of introducing the various facilities and services of the BRT or LRT alternatives along the Purple Line corridor. More specifically, this section is concerned with the degree to which the alternatives reduce or create the potential for injury or accident from on-site or off-site hazards to personal safety and security. The assessment, focused on the local, project-vicinity level, examines potential impacts on safety during construction and operations, as well as

construction and design features to reduce hazards and increase public safety.

4.13.1. Existing Safety Conditions

Streets along which the Purple Line would operate are urban arterials that currently carry relatively high volumes of auto, bus, and truck traffic. The majority of the intersections are signal controlled with some level of turning restrictions or other types of signage controls. Most of these streets have frequent and regular bus service operating on them; typically along the curb lanes. Throughout the corridor, pedestrians cross the streets at intersections, many with "WALK-DON'T WALK" signals as part of the traffic light cycle.

Transit passengers in the corridor currently use curbside bus stops, often crossing a number of streets to gain access. In addition, transit passengers use sidewalks and crosswalks to access the Metrorail/MARC stations, which are typically in areas with high traffic volumes.

The area around the intersection of New Hampshire Avenue and University Boulevard is undergoing a Maryland State Highway Administration program to improve pedestrian safety, including the construction of median fencing and barriers to prevent jaywalking and direct pedestrians to designated crosswalks at the intersections.

4.13.2. Potential Impacts to Safety and Security

General traffic and bus volumes will increase under the No Build because of general growth in population, employment, and travel.

The planned Takoma/Langley Transit Center at the intersection of New Hampshire Avenue and University Boulevard is intended to consolidate bus stops in the area and promote safer pedestrian circulation by reducing the amount of street crossings required to transfer between bus routes in the area.

Bus operations for the TSM Alternative would be similar to that for the No Build from a safety and security standpoint.

The Build alternatives would reduce, or at least maintain, the number of buses in curb lanes along the proposed routes, especially for all the LRT alternatives and High Investment BRT, which generally would have transit operating in median lanes. Overall, the Build alternatives would maintain or slightly reduce the number of transit vehicles, buses or LRT, operating along those streets, as some existing routes would be replaced by the BRT or LRT alternatives or would reduce the required number of buses in operation under the No Build. General vehicular traffic would typically remain the same for the No Build on streets where the transit alternatives would operate. Little, if any, diversion of traffic onto adjoining neighborhood streets is expected as these streets do not typically offer attractive parallel routes. While the Build alternatives would attract some auto users to transit and reduce the level of auto travel in the corridor (see Chapter 3), the amount of reduced traffic on any given street and the effects on safety would not be noticeably different.

The typical urban auto/pedestrian environment and types of traffic controls that exist today and are familiar to drivers and pedestrian in the corridor are similar to what would exist under any of the BRT or LRT alternatives, although to some degree the conditions and potential conflict would improve.

Transit vehicles operating along the curb lanes, as would occur in a limited number of instances for Low and Medium Investment BRT is a familiar condition for drivers and pedestrians. LRT along the north side of Bonifant Street would be a new transit condition. BRT or LRT with two lanes or tracks in the center of the street would introduce a new type of transit condition along the arterial roadways proposed for the Purple Line operations, including: Wayne Avenue, Piney Branch Road, University Boulevard, Campus Drive, Paint Branch Parkway, River Road, East West Highway, and Veterans Parkway. The types of traffic controls, turning restrictions, and other techniques that would be employed throughout the corridor would be comparable to what exists today in the corridor. At some locations, such as where Medium Investment BRT or Low or Medium Investment LRT would cross the intersection of Wayne and Fenton Avenues, special traffic signal phases and signage would be used to enable transit vehicles to make necessary maneuvers. Similarly, where East West Highway travels under the Baltimore Washington Parkway, the alignments for Medium Investment BRT and Low and Medium Investment LRT would transition from dedicated to shared lanes at the underpass and then back to dedicated lanes and would use special traffic signal phases and signage to enable the transit vehicles to make the necessary maneuvers.

Low and Medium Investment BRT and LRT would operate along Campus Drive through the central portion of the University of Maryland campus. The Preinkert/Chapel Drive design option for these alternatives would also operate on the surface. Campus Drive is subject to high pedestrian crossing volumes when classes are changing and during special events, such as football games; however, pedestrians, general traffic, and transit vehicles safely co-exist today along Campus Drive. On a typical weekday when school is in session, Campus Drive carries about 7,000 vehicles between 6 a.m. and 7 p.m., including 5,500 passenger vehicles, 500 University vehicles; 500 University of Maryland Shuttle Buses; 250 other transit bus vehicles (WMATA and TheBus); and 250 delivery vehicles. During peak pedestrian activity (the 15 minutes between classes) pedestrian crossings slow vehicular traffic. The Build alternatives that would operate along Campus Drive would be comparable to typical urban and major activity centers where BRT and LRT services safely operate throughout the United States and Europe, including a number of university and college environments. Under all the Build alternatives, the BRT or LRT service would take the place of existing bus transit services between the campus and the College Park Metro Station and the campus and Silver Spring, reducing the number of transit vehicles on Campus Drive by an estimated 50 to 60 vehicles a day. Under Low Investment BRT and LRT, the Purple Line transit service would operate in the same conditions as buses do today. Under Medium Investment BRT and LRT, general vehicular traffic would be restricted along Campus Drive between Union Drive and the "M" Circle as called for in the University of Maryland Master Plan. This restriction would substantially reduce potential pedestrian/vehicle conflicts. This design would also provide an open pedestrian plaza concept. For these alternatives, the design of the transit facility and crosswalks would incorporate features to promote transit-pedestrian safety. Under High Investment BRT and LRT, the transit alignment and station would be in tunnel through the main portion of campus, thereby further reducing the potential for pedestrian/vehicular conflicts.

The Preinkert/Chapel Drive design option would travel through an area that currently consists of some parking lots and roadways at its eastern and western ends, while the central portion would cross a largely pedestrian-oriented campus quadrangle environment. This central portion currently has no regular vehicular traffic so that this design option would introduce transit vehicles, both the Purple Line services as well as possibly some of the Campus shuttles and other bus services, into an otherwise pedestrian

environment. Various measures would be needed to alert pedestrians of the presence of the transit vehicles and provide designated areas for pedestrian crossings.

Throughout the corridor, passengers would access curbside stations via sidewalks as they do with bus stops today. Access to center platform BRT and LRT stations would be via signal-protected crosswalks at intersections or special crossing locations.

The BRT and LRT stations would incorporate design features to promote security and safety, such as lighting and communications. The operator of the Purple Line and local police would be responsible for patrolling both the stations and the vehicles.

Informational and educational safety campaigns for drivers, pedestrians, and transit users would begin prior to the start of operations for any Build alternative.

Public safety involving design and engineering of the facilities and the nature of the materials used are addressed by state and local building codes and design standards used by MTA in the development of the facilities. Moreover, the MTA, through detailed design would continue to work closely with the counties and local municipalities and adjacent communities to consider the incorporation of additional design features to promote safety and security for transit patrons and trail users.

Design principles consistent with Crime Prevention through Environmental Design (CPTED) would be incorporated into the planning and design of the alternative selected for implementation. CPTED incorporates natural approaches to designing safer facilities. For example, “natural surveillance” is a CPTED design aspect that incorporates unobstructed sight lines, open space, and other facility layout features that enhance the ability of police, security guards, the public, and transit patrons to observe public areas and thereby deter crime.

The stations would incorporate lighting and, where appropriate, closed-circuit television to deter unwelcome behavior. Station designs would be open and activities easily observable.

Under the LRT and High Investment BRT Alternatives, tunnel portals would be introduced into the East Silver Spring community and, for High Investment BRT and LRT in the University of Maryland. Tunnel portals are typically restricted with fencing. Portals for the Purple Line would typically be located in street environments. Intrusion prevention, detection, and alert/response technologies would be used for both security and safety purposes. These could include motion detectors or closed circuit television monitors. Transit vehicle controls and design features, as well training for transit vehicle operators, would be used to address concerns regarding vehicle and pedestrian conflicts in or near the tunnel portals.

Along the Georgetown Branch right-of-way the LRT and Medium and High Investment BRT Alternatives would be built in conjunction with the Capital Crescent Trail. Montgomery County also has plans for the Green Trail, a multi-use trail along Wayne Avenue between downtown Silver Spring and Sligo Creek Park. Trails along transit facilities successfully co-exist in the United States and Europe. BRT and LRT operate throughout the world in and along streets and sidewalks, as well as many pedestrian environments. In the Georgetown Branch right-of-way, the Interim Georgetown Branch Trail currently has a gravel surface, no shoulders, and street-level crossings of Connecticut Avenue, Jones Mill Road, and Steward Avenue. In the west Silver Spring area, the trail east of the CSX Metropolitan Branch right-of-way extends along existing roadways. Under all alternatives, the trail’s street-level crossing of Woodmont Avenue that connects the existing Capital Crescent Trail to the west and the proposed new trail would continue to do so. Where the Purple Line would be constructed in the Georgetown Branch right-of-way, the design of the transitway and trail would provide for a paved 10-foot trail surface with 2-foot shoulders and would incorporate a landscaped buffer between the transit facility and the trail. Typically this buffer would be a minimum of 10 feet in width. In most locations, a 3-4 foot vertical difference in the grade of the trail relative to the transit facility, as well as visually appropriate fencing and landscaping would be used to provide a further degree of separation, both visual and physical. At several locations, grade separated crossings of the trail with the transit facility would be provided; at street crossings near station locations, a clearly marked crossing would be introduced, as is typical in street pedestrian environments. Under all the alternatives, the trail would have a separate facility over and along the CSX Metropolitan Branch right-of-way into the Silver Spring Transit Center, eliminating the street-running trail in the west Silver Spring area. All Build alternatives, except Low Investment BRT, would use the Georgetown Branch right-of-way between Bethesda and Jones Mill Road, in addition to having a new grade-separated crossing of Jones Mill Road for the trail. Under High Investment BRT and Medium and High Investment LRT, the trail would be grade-separated at the crossing of Connecticut Avenue. Under Low Investment LRT and Medium Investment BRT and LRT the trail would cross Wisconsin Avenue at street level and follow a series of local streets in the Bethesda area to tie into the existing Capital Crescent Trail as it does today when the interim trail connection under Wisconsin Avenue is closed during the evening and night time periods.

Construction of the Purple Line at grade would involve typical street construction, including along the Georgetown Branch right-of-way. Tunnel construction would be similar to what was used for the Metrorail construction or along the Metrorail Red Line/CSX Metropolitan Branch in Silver Spring. Construction would not involve any unusual or particularly dangerous construction types, procedures, or locations that would pose any significant safety or security risks. Standard construction safety practices, as established by government regulations and codes, as well as MTA specifications, would minimize the potential for accidents and other safety problems.

Some construction would require temporary detours or reduced roadway capacity. Traffic safety maintenance measures would be employed to minimize this risk.

4.13.3. Safety and Security Conclusion

Given that the streets along which the BRT and LRT would operate already have high frequency bus operations, the types of conflicts among traffic, transit, and pedestrians under any alternative would be similar to conditions existing today. Because the number of buses would be comparable to, or slightly less than those on the streets with transit improvements, the potential for conflicts would be similar to that currently experienced and similar to that for the No Build and TSM alternatives. Traffic and transit controls as well as pedestrian safety strategies would be used to manage any potential conflicting movements.

The proposed transit facility would be designed to be compatible with the safe and secure use of the planned trails, as has been the experience for similar facilities elsewhere.

The type of construction activities for BRT and LRT would be very similar to typical street and Metrorail construction methods used today and would not introduce any unusual risks.

4.14. Utilities

The construction of a light rail transitway in a street would impact existing utilities. Handholes, valve boxes, manhole entrances, and signal loop detectors could be expected to be in conflict with the surface facility and would require relocation or restoration on a case-by-case basis. Manholes can frequently be modified by reorienting the stack to eliminate a conflict with a rail or other fixed feature of the guideway. Overhead utilities such as power and communication lines, traffic signals and signage would be relocated or reconstructed as necessary to clear catenary or construction equipment. Foundations for catenary poles, even though behind the curb line, could necessitate relocating shallow, or even deep, utilities.

There would be minimum impacts to utilities for a bus rapid transitway except where the alignment is in a retained earth cut or a retained earth fill, in which case the utilities within the zone of influence would require relocating.

It could be necessary to replace older underground utilities (water mains, sanitary and storm sewers, gas mains, telephone conduits, electrical conduits, fiber optic communication systems), presently parallel to the proposed transitway within the zone of influence to a location outside the zone of influence. Older utilities transverse to the proposed LRT could require replacement and or adjustment to a point 5 feet beyond the zone of influence. It could also be necessary to replace or reinforce older or more vulnerable utilities located over bored tunnels, but within the zone of influence and potential surface settlement. Older cast iron pipes with lead joints, frequently used in the past in water and gas distribution systems, cannot withstand differential settlements. Conduit systems would require monitoring for settlements and could require replacement of conduits and cables if tunnel construction caused settlements that are unacceptable.

MTA's precedent in earlier tunnel construction and for light rail surface construction has been to replace these older, vulnerable utilities prior to constructing light rail. In these cases, the procedure has been to identify the limits of influence and replacement in concert with the utility owner and enter into agreements to have the utility relocated either by the owner or by MTA's contractor(s), preferably prior to the construction.

When the preferred alignment is selected one of the major tasks of preliminary engineering and final design would be a thorough utility search, including test pits as necessary, to identify size, age, and location of underground utilities and to develop strategies for maintaining, protecting, or relocating utilities that could be influenced by construction.

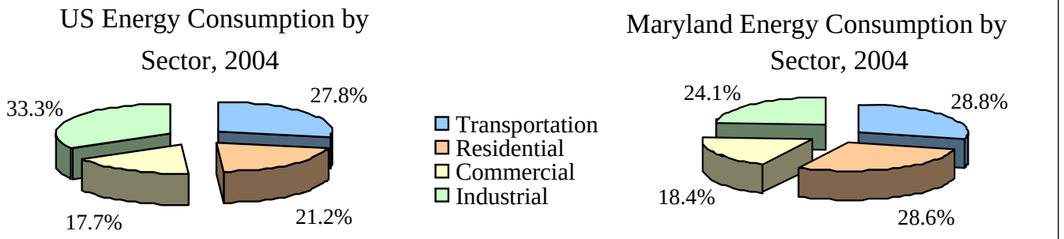
Temporary service disruptions could be expected during any required relocations. Construction activities would be planned and scheduled to minimize utility service outages to the greatest extent possible. All work involving the relocation and protection of utilities would be coordinated with and approved by the utility owner. Planned outages would require notification of the affected utility users.

4.15. Energy Analysis

4.15.1. Affected Environment

Energy is commonly measured in terms of British thermal units, or Btus. A Btu is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. For transportation projects, energy use is predominantly influenced by the amount of fuel used. The average Btu content of fuels is the heat value (or energy content) per quantity of fuel as determined from tests of fuel samples.

Figure 4.15-1: Energy Consumption by Sector



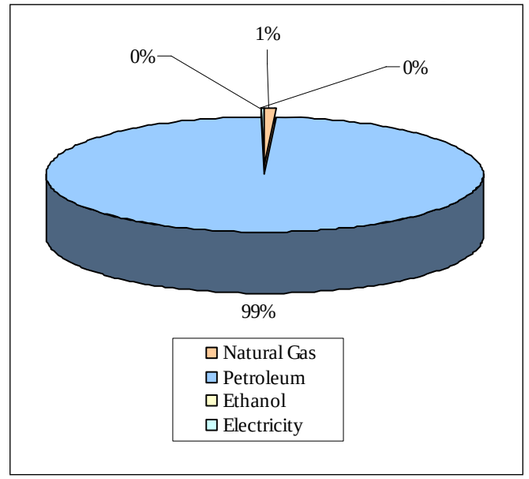
As shown in Figure 4.15-1, transportation is the second largest source of energy consumption in the United States. In Maryland, the transportation sector is the largest source of energy consumption. On a per capita basis, Maryland's transportation energy consumption is 75.3 million Btus, which is below the United States per capita average of 93.1 million Btus (USDOT, 1993). As shown in Figure 4.15-2, petroleum (e.g., gasoline, diesel fuel, and jet fuel) is the predominant source of energy for transportation in Maryland.

Transportation energy is generally discussed in terms of direct and indirect energy. Direct energy involves all energy consumed by vehicle propulsion. This energy is a function of traffic characteristics such as volume, speed, distance traveled, vehicle mix, and thermal value of the fuel being used. Indirect energy consumption involves the non-recoverable, one-time energy expenditure involved in constructing the physical infrastructure associated with the project.

4.15.2. Environmental Consequences

This section provides a quantitative assessment of the project's impact on transportation-related energy consumption in the corridor. Two methodologies currently used to estimate a project's energy consumption were applied. The first is based on the analysis techniques discussed

Figure 4.15-2: Maryland's Transportation Energy Consumption by Energy Source



Source: U.S. Department of Energy, Energy Information Administration, State Energy Data 2003 Consumption, Washington, D.C.: 2006. URL: http://www.eia.doe.gov/emeu/states/_states.html as of Oct. 26, 2006.

in the report *Energy And Transportation Systems* (California Department of Transportation (Caltrans) and the U.S. Federal Highway Administration (FHWA), 1983), as well as *Urban Transportation And Energy: The Potential Savings Of Different Modes* (Congress of the United States, 1977). The second methodology is based on factors in the *Transportation Energy Data Book, Edition 26* (U.S. Department of Energy, 2007).

The direct energy impacts were calculated for the project using both methods. The analyses produced similar results in that both showed approximately the same percentage reduction in roadway vehicular energy demand. Given the age of the source data for each of the analysis techniques, and the fact that the 1983 data must be brought up to date using a series of correction factors, only the results from the *Transportation Energy Data Book* (U.S. Department of Energy, 2007) are presented.

Direct Energy

As shown in Table 4.15-1, the project is predicted to have little or no effect on overall energy consumption in the project area. Roadway energy is predicted to decrease under all the alternatives with the exception of the TSM alternative. This is due to the predicted changes in vehicle miles traveled (VMT) under the build alternatives as compared to the No Build. Overall total energy levels are predicted to increase under the TSM alternative (0.04 percent) and decrease under the remaining alternatives. The Medium Investment BRT and LRT, as compared to the No Build, are predicted to demonstrate the largest overall energy reduction (0.07 percent), followed by High Investment BRT (0.05 percent), Low Investment LRT (0.03 percent), High Investment LRT (0.02 percent), and Low Investment BRT (zero percent).

Table 4.15-1: 2030 Direct Energy Consumption

Mode	No Build	TSM	Low Investment BRT	High Investment BRT	Low Investment LRT	High Investment LRT
Roadways						
Daily VMT	261,009,000	260,954,000	260,894,000	260,907,000	260,928,000	260,920,000
Average speed (mph)	24.4	24.4	24.4	24.4	24.4	24.4
Energy intensity						
Auto (Btus)	261,580	261,525	261,465	261,478	261,499	261,491
Light trucks (Btus)	862,884	862,702	862,504	862,547	862,616	862,590
Heavy trucks (Btus)	364,462	364,385	364,301	364,320	364,349	364,338
Total roadway Btus (millions)	1,488,926	1,488,612	1,488,270	1,488,344	1,488,464	1,488,418
% Change from Baseline	-	-0.02%	-0.04%	-0.04%	-0.03%	-0.03%
Btus per passenger miles (Assuming 1.2 passengers/vehicle)	4,754	4,754	4,754	4,754	4,754	4,754
Total Btus (million) per passenger mile	1,240,772	1,240,510	1,240,225	1,240,287	1,240,387	1,240,349
LRT						
Daily VMT	0	0	0	0	7,599	7,731
Electric propulsion Btus (millions)	0	0	0	0	652	663
Btus per passenger miles (assuming 22.4 passengers/vehicle)	0	0	0	0	3,828	3,828
Total Btus (million) per passenger mile	0	0	0	0	29	30
BRT						
Daily VMT	0	7,166	7,967	7,887	0	0
Total BRT Btus (millions)	0	306	340	337	0	0
Btus per passenger miles (assuming 8.7 passengers/vehicle)	0	4,907	4,907	4,907	0	0
Total Btus (million) per passenger mile	0	35	39	39	0	0
Total (Roadways, LRT & BRT)						
Daily direct energy Btus (millions) consumed	1,488,926	1,488,918	1,488,610	1,488,681	1,489,116	1,489,081
Total daily direct energy (Bbl) consumed	256,711	256,710	256,657	256,669	256,744	256,738
% Change from No Build	-	0.00%	-0.02%	-0.02%	0.01%	0.01%
Total (Roadways, LRT & BRT) in terms of Passenger Miles						
Daily Direct Energy Btus (millions) Consumed	1,240,772	1,240,545	1,240,264	1,240,325	1,240,416	1,240,378
Total Daily Direct Energy (Bbl) Consumed	213,926	213,887	213,839	213,849	213,865	213,858
% Change from No Build	-	-0.02%	-0.04%	-0.04%	-0.03%	-0.03%

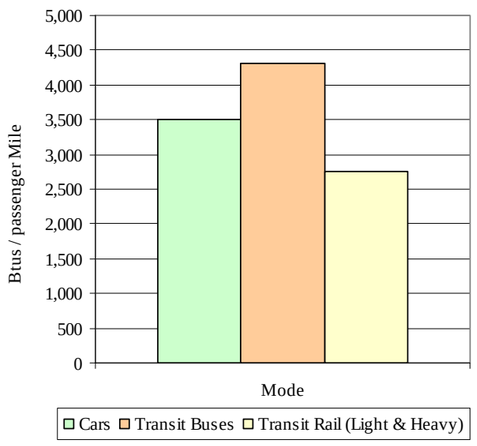
References:
U.S. Department of Energy, Transportation Energy Data Book: Edition 26-2007
American Public Transportation Association, 2007 Public Transportation Fact Book
Fuel Consumption for Propulsion of BRT = 42,690 Btus/Vehicle-Mile (Assuming Average annual percentage change of +0.5 percent per year based on 2005 btu of 37,498)
Fuel Consumption for Propulsion of LRT = 85,747 Btus/Vehicle-Mile (No Average annual change is applied - info. not available).
Note: One British thermal unit (Btu) is the quantity of energy necessary to raise one pound of water one degree Fahrenheit
Conversion Factors: United States Department of Energy, 2007; Transportation Energy Data Book: Edition 26

In terms of energy per passenger mile, Medium Investment LRT Alternative, as compared to the No Build, is predicted to demonstrate the largest overall energy reduction (0.09 percent) followed by Low and High Investment LRT (0.07 percent) High Investment BRT (0.06 percent) and Low Investment BRT (0.02 percent). The TSM Alternative is predicted to increase total energy use in terms of Btus/ passenger mile by 0.02 percent, as compared to the No Build.

All changes in energy consumption are less than 0.10 percent, making them essentially immeasurable.

The difference in overall energy usage versus energy usage per passenger mile is due to the fact that Btu per passenger mile varies by mode, as shown in Figure 4.15-3. The Btu per passenger miles are based on general load factors from the U.S. Department of Energy's report titled *Transportation Energy Data Book, Edition 26*, dated 2007.

Figure 4.15-3: Energy Intensities by Mode



Indirect Energy

Indirect energy is the energy needed to construct the project. Accurate indirect energy costs are extremely difficult to estimate given the uncertainty of field variables at this point in the analysis. The indirect energy values calculated should be considered as an indicator between alternatives, rather than absolute values. Construction energy factors estimate the amount of energy necessary to extract raw materials, manufacture and fabricate construction materials, transport materials to the work site and complete construction activities.

The analysis is based on the number of lane miles or track miles to be constructed for each alternative. Estimates of construction energy reflect at-grade, elevated and below grade construction. As shown in Table 4.15-2, indirect energy expenditures are predicted to be highest for LRT. This is due to the higher energy requirements estimated for constructing one track mile as compared to one roadway mile.

Measures to Conserve to Energy

Conservation of energy could be achieved in facility planning, construction, operation, and maintenance. Conservation could also be applied to recycling pavements, hardware items (guardrails, signals, tires, right-of-way, etc.), using indigenous plants for landscaping, and applying Best Management Practices in roadway and track maintenance. Other measures that could be applied include using high pressure sodium vapor lamps for light, solar powered lighting, promoting use of carpools, vanpools, buses, bicycles, and walking for transportation.

4.16. Irreversible and Irretrievable Commitment of Resources

NEPA requires that the environmental analysis include identification of "…any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible or irretrievable commitment of resources results in the permanent loss of a resource for future uses

Table 4.15-2: Indirect Energy Consumption

Type of Construction	Number of Track or Lane Feet	Number of Track or Lane Miles	Btus Consumed (millions)
Low Investment BRT			
Track at Grade	0.0	0.0	0.0
Track Elevated or Below Grade	0.0	0.0	0.0
Track Total	0.0	0.0	0.0
Surface Roadways	172,162.0	32.6	195,638.7
Elevated Roadways	6,325.0	1.2	17,120.6
Roadway Total	178,487.0	33.8	212,759.3
System Total	**178,487.0**	**33.8**	**212,759.3**
High Investment BRT			
Track at Grade	0.0	0.0	0.0
Track Elevated or Below Grade	0.0	0.0	0.0
Track Total	0.0	0.0	0.0
Surface Roadways	124,014.0	23.5	140,925.0
Elevated Roadways	52,692.0	10.0	142,627.7
Roadway Total	176,706.0	33.5	283,552.8
System Total	**176,706.0**	**33.5**	**283,552.8**
Low Investment LRT			
Track at Grade	143,856.0	27.2	445,226.2
Track Elevated or Below Grade	26,396.0	5.0	277,258.1
Track Total	170,252.0	32.2	722,484.3
Surface Roadways	0.0	0.0	0.0
Elevated Roadways	0.0	0.0	0.0
Roadway Total	0.0	0.0	0.0
System Total	**170,252.0**	**32.2**	**722,484.3**
High Investment LRT			
Track at Grade	119,522.0	22.6	369,913.8
Track Elevated or Below Grade	53,692.0	10.2	563,969.6
Track Total	173,214.0	32.8	933,883.4
Surface Roadways	0.0	0.0	0.0
Elevated Roadways	0.0	0.0	0.0
Roadway Total	0.0	0.0	0.0
System Total	**173,214.0**	**32.8**	**933,883.4**

Notes: USDOE's Assessment of Energy Impacts of Improving Highway Infrastructure Materials, 1995
Minor Bridge Rehab in urban area (mbtus/lane-mile) 14,292 mbtus/track mile
Surface highway major widening (mbtus/lane-mile) 6,000 mbtus/track mile
Energy and Transportation Systems, Caltrans, 1983; New York State Draft Energy Analysis Guidelines for Project Level Analysis - 2003.
LRT track construction (mbtus/track mile) 16,341.2964 mbtus/track mile
LRT Elevated / tunnel track construction (assumes track and bridge rehab energies) 30,633.2964 mbtus/track mile

(or alternative purposes) as they cannot be replaced or recovered.

The No Build would not require an irreversible and irretrievable commitment of resources.

Should the TSM alternative include modifications to intersections to accommodate queue jump lanes, property in these locations would be irreversibly impacted.

The Build alternatives would require a similar commitment of natural, human, and monetary resources. Natural resources include the land on which the project would be constructed, water resources, and habitat. Since the Build alternatives would be generally constructed in existing rights-of-way, potential effects on natural resources are minimal. Other natural resources consist of the fossil fuels, energy, and materials such as cement, aggregate and bituminous material (for example, asphalt) that would be used in construction.

The use of energy is considered an irretrievable commitment of resources because the energy used during construction or operations is unlikely to be used again for some other purpose. The Build alternatives would require a net increase in energy consumption for construction and, once built, a slight decrease in energy consumption annually over existing conditions (refer to the Energy Section 4.15).

Construction of the Build alternatives would require a one-time expenditure of federal, state, and local funds, which are irretrievable in the sense that these funds would not be available for other projects.

For the same reason, the commitment of human resources during construction activities is considered irretrievable. The project would require the use of human resources in the manufacture and preparation of construction materials and in the physical effort required to build the project. However, the project would not have a long-term effect on the continued availability of human resources (workers).

4.17. Construction Impacts

Construction of the Purple Line has the potential to cause temporary impacts to the surrounding environment. Typical short-term construction impacts could include noise, vibration, air quality, and water quality. If properly planned, construction impacts to neighborhoods, businesses, and the natural environment can be minimized.

4.17.1. Air Quality

Air quality impacts from construction activities are temporary and are primarily associated with emissions of diesel-powered equipment and dust generated by excavation and hauling activities. Air polluting emissions from construction equipment can be minimized by proper engine maintenance and code enforcement.

Fugitive dust is generated as trucks travel on temporary haul roads and from handling of excavated materials and debris and bulk construction materials such as cement and fine aggregate. Dust is also generated by wind erosion of unprotected or non-stabilized earth surfaces and stockpiles. Dust control measures such as the following can substantially minimize fugitive dust impacts: application of water and calcium chloride to haul roads; providing and using truck wheel wash stands where vehicles enter public/paved streets; enforcing the Maryland law requiring covered trucks; minimization of exposed, erosion prone areas to the greatest extent possible; stabilization of exposed earth with grass, geotextile fabric, ground cover, paving, or other finished surface as early as possible; covering or shielding stockpiled materials from the wind.

4.17.2. Noise and Vibration

Noise impacts from construction activities are a function of the noise generated by construction equipment, the proximity of construction to sensitive land uses, and the timing and duration of the noise generating activity. Typically, the various phases of a construction project would generate different levels and quality of noises based on the mix of equipment in use at that time. The dominant source of noise from most construction equipment is the diesel engine. Impact pile driving, pavement breaking, blasting and back-up alarms are the exceptions to this generalization.

Measures that can be employed to minimize construction noise fall into two general categories: 1) design considerations; and 2) construction staging or sequencing of operations. Design considerations would include erecting temporary walls or earth berms between the noise source and the sensitive receptor, the identification of haul routes that avoid sensitive receptors to the maximum extent possible; and locating stationary noise generating equipment at a distance from sensitive receptors. Construction activities should be planned to avoid prolonged noise generating activities and to minimize construction activities during the most sensitive times of day or night.

Construction of underground stations, shafts, and portals could be facilitated by support of excavation systems using soldier piles placed in pre-augered holes, with timber lagging or tremie concrete (slurry walls). Tunnel shafts and portals could be constructed by the same technique. The goal during the construction phase would be to avoid blasting, but if the need were encountered, local codes and restrictions would prevail. The major noise generators related to the tunnel and station construction would be associated with the mucking operation and the tunnel ventilation plant during excavation. Properly installed and maintained mufflers on diesel equipment and air compressors substantially reduce noise impacts.

Construction activities can result in varying degrees of ground vibration, depending on the equipment and methods used. Operations of construction equipment cause vibrations that spread through the ground and diminish in strength with distance. Construction activities that typically generate the most severe vibrations are impact pile driving and blasting. The goal would be to minimize these activities and closely monitor them during construction. Smaller, less perceptible vibrations would also occur in tunneling, primarily as each “shove”, or advancement by the hydraulic jacks occurs.

Mitigation measures could include restrictive specifications for vibration sensitive operations. Recognizing the possibility that some damage could occur to adjacent structures, a preconstruction survey, including a detailed photographic record of existing conditions, would be conducted and restitution or repairs made based on actual damages where determined to be a result of construction activities. Construction staging considerations could include limited hours of loading and hauling operations, stockpiling excavated materials in the station excavation during non-haul hours and the use of rubber-tired excavation equipment in lieu of tracked equipment.

4.17.3. Water Quality, Wetlands and Floodplains

Earthwork, including clearing and grubbing, excavating, grading, embankment construction, and stockpiling would be required during the construction of the project. Exposed soils could result in increased site erosion and sedimentation impacts to nearby water resources. The construction of tunnels and underground stations, and possibly other system elements, would require dewatering of excavation sites. The

dewatering water could contain suspended sediments and contaminants that could affect receiving waters.

A Storm Water Pollution Prevention Plan would be prepared and implemented. This plan would, as a minimum, identify appropriate Best Management Practices and include a detailed monitoring program such as: conducting earthwork activities during a known dry season; diverting stormwater that originates offsite away from the construction site; minimizing disturbances of wetlands and floodplains; minimizing the extent and duration of exposed soils by using temporary or permanent seeding, mulching or geotextile matting; proper use of hay bales and silt fencing; constructing appropriately sized temporary sedimentation basins; establishing a bermed construction equipment storage and refueling area; establishing designated equipment washing/cleaning area that is bermed and includes some measures for the treatment of runoff prior to discharge; establishing an emergency response spill contingency plan; restoring wetlands and floodplains to their pre-existing condition as early as possible.

4.17.4. Contaminated Soils and Hazardous Materials

Some soil contaminants could be expected along portions of the corridor in the underlying soils. An Initial Site Assessment was conducted to identify possible sites of hazardous materials. These could be from former industrial land uses, existing and former sites of gasoline filling stations, and railroad yards.

Most of the surface alignment would be constructed in existing streets. Excavations for a new LRT track slab or a BRT lane would be no deeper than the existing pavement section, and would not be expected to encounter soil contaminants or hazardous materials. In deeper excavations, for instance for utility relocations, contaminants could be encountered.

In tunnels however, much of the profile would be below the groundwater elevation at which many petroleum products from spills or leaking tanks remain suspended and are exposed as excavations and tunnels penetrate the water surface en route to a deeper elevation. Some volatile organic compounds could be expected and as a precautionary measure the specifications would require explosion proofing of all tunneling equipment, including the boring machine, trailing gear, and all incidental equipment that would operate in the tunnel environment. An appropriate ventilation plant would be established for tunneling in the event that an unexpected encounter with a volatile material could classify the tunnel as gassy.

4.17.5. Maintenance of Traffic

Construction activities would result in temporary interruptions to both vehicular and pedestrian local traffic patterns. During various stages of construction, additional traffic would be generated by hauling of construction debris, excavation spoils and building materials. Maintenance of traffic and construction staging would be planned and scheduled to minimize traffic delays and interruptions to the maximum extent possible. Coordination with and approval by the involved jurisdictions would be required. Appropriate signing would be used to notify motorists of road closures and detours. Access to residences and businesses would be maintained to the maximum extent possible. Emergency access for fire fighting equipment and evacuations would be maintained at all times. Upon completion of work in an area, the effected roadways and access would be restored as soon as possible.

Traffic impacts would be minimized by invoking performance specifications. It would be incumbent on construction contractors to develop traffic maintenance details consistent with their work plans and schedules and obtain approvals from the affected jurisdictions.

4.17.6. Utilities

Temporary service disruptions could be expected during the utility relocation process. Construction activities would be planned and scheduled to minimize utility service disruptions to the greatest extent possible. All work involving the relocation and protection of utilities would be coordinated with and approved by the utility owner. Planned outages would require notification of the effected utility users.

4.17.7. Construction of LRT in Street Lanes

Construction activity is essentially the same environmentally, whether the tracks occupy dedicated lanes or shared traffic lanes, except that dedicated lanes could be textured or slightly elevated to distinguish them from auto traffic lanes. In all cases, tracks would be mountable so they can be easily crossed by vehicles and pedestrians. Modern LRT embedded track typically involves continuously welded rail (CWR), electrically isolated by rubber boots or other means, embedded in either cast-in-place or precast concrete. Track profiles are generally held to the profile of the existing street to minimize the amount of work needed to match adjacent elevation.

There are, generally, cost advantages to the cast-in-place system and schedule advantages to the precast system. Both types could be used in various segments of the Purple Line.

Due to the difficulties in transporting quarter-mile rails through city streets, a portable plant would be placed ahead of or behind the excavated segment currently under construction, and as rails are welded, they would be pulled on rollers, with rubber tired equipment into or alongside the segment under construction until a sufficient length of rail is welded to complete the construction segment. Track assembly and concrete work would be completed for the segment and the operation moved to the next segment. As segments were completed, usually at the rate of about a block per week, the adjacent pavement would be surfaced and the segment restored to traffic. It is customary, where possible, to implement the new traffic pattern so motorists become accustomed to it, before Purple Line operations begin.

4.17.8. Construction Impacts and Mitigation for Various Types of Transit Operation

Construction impacts will vary throughout the corridor due to the differences in the street characteristics (i.e. lane or street widths, travel direction, presence or absence of parking and turn lanes, etc.), the type of running way and, in some cases, the street frontage along the route. In addition, at any particular location in the corridor, the impacts would vary depending on the type of transit operation proposed (i.e. shared, dedicated, or exclusive transit lanes), as discussed elsewhere in this document. A general discussion of the level and type of impacts follows.

Shared Lanes (BRT only)

Construction for this type of transit operation typically involves spot repairs that are needed to smooth the riding surface, and would result in the lowest level of impacts. The type of construction could include some or all of the following: pothole repairs; inlet and manhole structure repairs and cover adjustments; failing underground pipe and conduit repairs; roadway base (below surface) repairs to remove dips and humps; ‘crown’ adjustments, where needed, at cross street intersections (create smoother transitions); spot resurfacing to repair cracked or

shoved (washboard) pavement; new pavement marking/signage installation; and sidewalk repairs and improvements near stations, discussed elsewhere.

Level of Impacts

Short duration access, noise, and vibration impacts would be experienced by businesses and residents near affected locations. Wherever possible, construction would generally be confined to non-rush-hour periods. Spot lane closures could be required.

Lessening Potential Impacts

Advance warning for lane closures and detours would be provided to neighboring business owners and residents and construction activities would adhere to state guidelines for temporary traffic control during construction.

Dedicated Transitway (Off-Street)

Construction for this type of transit operation typically involves the creation of a brand new roadway for BRT or trackbed for LRT, resulting in a higher level of disruption and impacts to sidewalk areas and, in some cases, properties through which the transitway runs. Ancillary construction could include: underground utility relocation and/or reconstruction; curb and sidewalk reconstruction; construction of new or modified storm drain systems; installation of overhead power supply (catenary) system and surface-level support systems (e.g. transformer boxes) for LRT; temporary lane closures for construction and/or staging areas; and pavement marking/signage installation.

Level of Impacts

The duration of impacts would be longer than with shared lane construction. Access to businesses and residents near affected locations could be temporarily disrupted. Some construction could need to occur during rush-hour periods. Longer lane closures could be required.

Lessening Potential Impacts

Temporary arrangements for pedestrian and vehicle access would be made with neighboring business owners and residents, where appropriate. Advance warning for lane closures or detours would be provided and would adhere to state guidelines for temporary traffic control during construction.

Curb Lanes

Construction for this type of transit operation typically involves the creation of a new travel surface for BRT or construction of trackbed for LRT. In areas where available right-of-way is restricted, sidewalk and curb adjustments or reconstruction could be required to reduce or eliminate property impacts. Ancillary construction could include: underground utility relocation and/or reconstruction; inlet replacements (with curb opening inlets) to avoid inlet damage from repeated wheel loads; manhole structure repairs, cover adjustments or relocations; bus pad construction for BRT; roadway surface milling for smoother transitions; installation of overhead power supply (catenary) system and surface-level support systems (e.g. transformer boxes) for LRT and pavement marking/signage installation.

Level of Impacts

More extensive repairs to curb lanes than with shared curb lanes would result in a greater level of impacts. Longer duration access, noise, and vibration impacts would be experienced by businesses and residents near affected locations. Some construction could occur during rush-hour periods. Longer lane closures could be required.

Lessening Potential Impacts

Temporary arrangements for pedestrian and vehicle access would be made with neighboring business owners and residents, where appropriate. Advance warning for lane closures or detours would be provided to neighboring business owners and residents and would adhere to state guidelines for temporary traffic control during construction.

Dedicated Lanes (in an Existing Roadway)

Construction for this type of transit operation typically involves the creation of a new travel surface for BRT or construction of trackbed for LRT along one side of a street. In areas where available right-of-way is restricted, sidewalk or curbs adjustments or reconstruction could be required to reduce or eliminate property impacts. Ancillary construction could include: underground utility relocation and/or reconstruction; inlet replacements (with curb opening inlets) to avoid inlet damage from repeated wheel loads; manhole structure repairs, cover adjustments or relocations; bus pad construction for BRT; roadway surface milling for smoother transitions; installation of overhead power supply (catenary) system and surface-level support systems (e.g. transformer boxes) for LRT and pavement marking/signage installation, construction of in-street station platforms; and removal of median and turn lanes.

Level of Impacts

Access, noise, and vibration impacts experienced by businesses and residents near affected locations would be longer and greater than with other alternatives. Some construction could occur during rush-hour periods. Longer lane closures could be required.

Lessening Potential Impacts

Temporary arrangements for pedestrian and vehicle access would be made with neighboring business owners and residents, where appropriate. Advance warning for lane closures or detours would be provided to neighboring business owners and residents and would adhere to state guidelines for temporary traffic control during construction.

4.17.9. Construction of Maintenance and Storage Facilities

Appropriate entrances and access roads into and through the job site would be constructed in compliance with environmental controls. Once site access was established, erosion and control measures within and around the perimeter of the site would be installed, a construction staging area would be set up, and clearing and grubbing and removal of existing structures would commence. At this point mass grading of the facility could start and then break into separate grading operations, one for the storage yard and the other for the maintenance facility. Subsurface utilities would be installed concurrent with the initial grading operations.

Grading in the storage yard would continue until the earthwork reaches subgrade, once the grade has been attained, sub-ballast for LRT or sub-base for BRT could be placed. At the building site deep depressions such as hoist equipment, sump and inspection pits would be excavated, formed, poured and backfilled. Throughout the remainder of the building site column and wall foundations would be built in a similar manner.

As the grading and foundation work in the building nears completion, construction of the floor slabs with embedded utilities could begin along with the erection of the steel columns and beams. While erection of the steel frame continues, the laying of exterior masonry walls could commence. After the steel framing “tops

out," roof trusses could be set followed by the installation of the deck and roofing system.

As construction of the exterior walls and roof continues the building becomes "closed in" and work on the interior can proceed without exposure to elements. In additional to working on widows, doors and interior walls, car maintenance and electrical equipment could be installed and readied for testing. In conjunction with the installation of equipment, tracks within the shop could be laid and backfilled flush with the shop floor.

While work on the maintenance facilities continues, work in the storage yard would progress. The perimeter fence and gates would have been installed; for LRT the ballast would have been placed, yard tracks would have been laid, switch machines, yard lighting, and the catenary system would have been installed.

As work on the storage yard nears completion, so would the finish work on the building. Air handling units, parapet coping and skylights would be set on the roof. Floor, wall, and ceiling finishes would be applied in the administration and yard operations areas. Electrical controls, fire and security equipment would be installed and tested. And as the project approaches closeout, parking lots would be paved and striped, sidewalks would be poured and planting areas would be landscaped.

4.18. Indirect and Cumulative Effects Analysis

An indirect and cumulative effects (ICE) analysis was conducted for the Purple Line. The analysis that was conducted in accordance with the *Maryland State Highway Administration's Secondary and Cumulative Effects Analysis Guidelines for Environmental Impact Statements and Environmental Assessments (2000)* was adjusted to more appropriately address transit.

Indirect Effects

Indirect, or Secondary, effects are those that are caused by an action and are later in time or further removed in distance but are still reasonably foreseeable" (Title 40, Code of Federal Regulations, Section 1508.8). The secondary impacts assessment examines whether reasonably foreseeable actions by others in response to the implementation of a project could create substantial social, cultural resource, or natural impacts.

Cumulative Effects

Cumulative effects are those "…impacts which result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions" (Title 40, Code of Federal Regulations, Section 1508.7). The analysis examines whether the combination of past losses of resources in the defined ICE study area, combined with direct and indirect impacts resulting a project, and other planned and future development by the design year could lead to undesirable losses of quality of life or environmental quality.

4.18.1. ICE Scoping

The ICE evaluation scoping generally followed procedures of the SHA's *SCEA Guidelines for Environmental Impact Statements and Environmental Assessments* (2000), modified for non-highway and non-commuter rail transit facilities located in a predominantly developed area. Scoping activities included the following, which defined the parameters for conducting the ICE analysis:

- Establish the ICE geographic boundary
- Establish the ICE past and future time frames
- Define resources to be analyzed in the ICE

ICE Geographic Boundary

The ICE geographic boundary was determined by overlaying maps of various elements to determine the area that would be sufficient to capture potential indirect and cumulative effects. This included mapping of natural resources, floodplains, wetlands, surface waters; forests/terrestrial habitat, and wildlife, community planning areas, traffic, public sewer and water service areas, and census tracts. The resulting ICE Boundary is shown on Figure 4.18-1

ICE Temporal Boundary

The time frames established for the Purple Line ICE analysis include a past time frame of 1964, and a future time frame of 2030. 1964 is the year *Wedges and Corridors: A General Plan for the Maryland-Washington Regional District* was published by M-NCPPC, the plan that has directed all development since that time. The future time frame 2030 is the Purple Line's design year.

Resources

Resources that would be directly impacted by the proposed alternatives determined which environmental resources to evaluate in the ICE:

- Communities
- Parks and Recreational Facilities
- Forests/Terrestrial Habitat
- Floodplains
- Cultural Resources
- Water Resources, including Wetlands

4.18.2. ICE Analysis Findings

Each of the Build alternatives will result in some impact to environmental resources. The differences between alternatives are not substantial as all Build alternatives will serve the same communities and the proposed stations are the largely same for each, except for Low Investment BRT, which includes a station at NIH and the Connecticut Avenue Station on Jones Bridge Road rather than adjacent to the Georgetown Branch right-of–way; and High Investment BRT and LRT, which do not include the station at Fenton Street.

Indirect Effects

Considering that the Build alternatives run predominately along existing roadways and transportation rights-of-way, there is limited potential for adverse, indirect community effects. Overall, the indirect effects of the Purple Line would include support improving mobility and access for residents, workers, and visitors and supporting economic and community development in the region.

Development within the ICE area is expected to occur in the immediate vicinity of the Purple Line stations, approximately ¼ mile radius. One quarter mile is the generally accepted distance that Americans will walk to a transit station, and is therefore used as the limit for development impacts. This would consist of transit-oriented development that would serve transit riders. Indirect impacts to natural resources due to growth within the ICE boundary are anticipated to be minimal, as most of the growth will occur in areas that are largely developed and zoned to accommodate the level of growth anticipated. This level of growth is expected to be consistent with general growth trends and projections and would not be expected to result in significant demands on resources or services. Local retail businesses within walking distance of the Purple

Line stations would be expected to benefit from potential increases in patronage from Purple Line riders, and access to major employers in the corridor would be improved. By improving transit linkages between employment centers, high density residential areas, and civic and institutional uses, the Purple Line would be expected to indirectly contribute to the economic growth and revitalization of the ICE boundary area. The Purple Line would also be expected to indirectly benefit the region by supporting State and regional policies. It would promote Maryland Smart Growth policies and goals, and efficient use of lands within Priority Funding Areas.

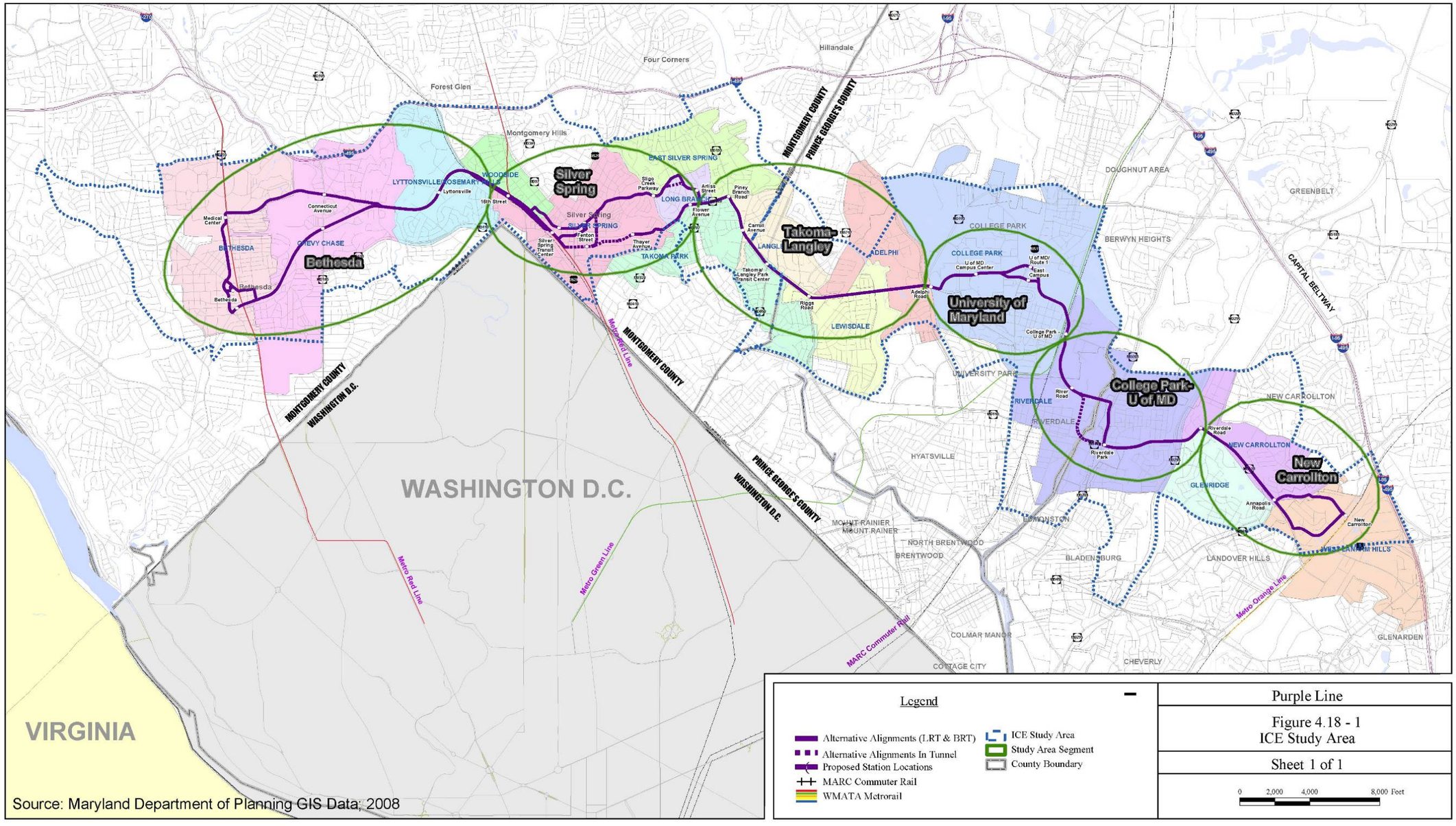
In summary, the Build alternatives would be expected to support the common themes of local and regional planning efforts that include preserving residential areas, focusing development in areas served by transit, and improving east-west transit and intermodal connectivity.

Cumulative Effects

Planned development in the ICE area is slated to occur regardless of the Purple Line. The planned developments are consistent with their surrounding land uses and are consistent with regional and local master plans. The vast majority of these developments are located in the Silver Spring area, with several in Chevy Chase/Lyttonsville, a few in Bethesda, College Park, and others distributed throughout the corridor.

The minimal impact to resources resulting directly and indirectly from the Purple Line would be an incremental change to the cumulative effects experienced by these resources over the time frame studied. Current federal, state, and local regulations require the replacement or protection of these resources so that they stay within sustainable thresholds of health.

Figure 4.18-1: ICE Study Area



Chapter 5
Costs and Funding

Chapter 5. Costs and Funding

This chapter presents the one-time capital cost for design and construction, as well as the annual change in operating and maintenance (O&M) costs and farebox revenues, for the TSM, BRT, and LRT alternatives. This chapter also discusses the financial setting for the evaluation of the improvements, including a discussion of MTA funding mechanisms and future financial outlook, and the strategy for funding the capital cost and operating and maintenance cost needs of the alternatives.

5.1. Capital Costs

5.1.1. Approach

Capital cost estimates have been developed in accordance with FTA guidelines. The guidelines call for cost estimates to be prepared and reported using the latest revision of FTA's Standard Cost Categories. In the estimates, cost components for the various alternatives are developed and summarized into the Standard Cost Categories. These cost categories form the basis for the format and structure that is used for the capital cost detail and summary sheets developed for this project. The *Capital Cost Estimating Methodology Technical Report* provides more detailed discussion on the methodology used to estimate capital costs.

The current FTA Standard Cost Categories consist of the following:

- Guideway and Track Elements
- Stations, Stops, Terminals, Intermodal
- Support Facilities (Maintenance and Storage Facilities, Administration Buildings)
- Sitework and Special Conditions
- Systems (Power, Control, Communication)
- Right-of-way, Land, Existing Improvements
- Vehicles
- Professional Services
- Contingency

Each of the alternatives under consideration for the Purple Line has a set of conceptual engineering drawings, typical sections, station locations, and written descriptions that provide the needed definition for each of the major cost components. These planning documents form the basis for the identification of the various infrastructure elements used to prepare the capital cost estimates. These facility elements can be classified into one of two broad groups, either typical or non-typical facilities. Typical facility costs are developed for elements that can be defined by a typical cross-section and applied over a given length of alignment or based on a conceptual scope of work developed as appropriate for a specific typical facility. The typical facility composite unit cost is developed by combining the costs for all of the individual construction elements applicable to a given typical section or facility and creating a representative composite unit cost. Typical sections or facilities have been developed for each of the alternatives.

Non-typical facility costs are developed based on conceptual engineering and design related to the unique facility under consideration. For non-typical facilities, elements necessary for overall system operation, but whose costs cannot be allocated to a specific geographic segment of the system (e.g., vehicles, maintenance and storage facility); these costs are included at the summary level. After details are prepared for both typical and non-typical facilities and the cost data are developed, they are put into a format summarizing overall alternative cost, as well as identifying the cost of various alignment segments.

5.1.2. Contingency

Contingency, in the statistical sense, is the estimated percentage by which a calculated value may differ from its true or final value. The contingency allowance is used to account for those items of work (and their corresponding costs) that may not be readily apparent or cannot be quantified at the current level of design, such as unknown project scope items or a potential project change resulting from public or political issues, or environmental or technical requirements. For the purposes of this study, contingency is divided into two major categories, allocated and unallocated.

Allocated contingency was based on the level of design information available for individual items of work, as well as the relative difficulty in establishing unit prices for these items. The allocated contingency allowance, in the range of five percent to 30 percent, will be allocated according to FTA construction or procurement cost categories. The exact percentage selected for each cost category is based on professional judgment and experience related to the cost variability typically seen for items of work within a particular cost category.

Unallocated contingency is similar to allocated contingency in that it is primarily applied as an allowance for unknowns and uncertainties due to the level of project development completed. The major difference is that allocated contingencies are intended to address uncertainties in the estimated construction, right-of-way, and vehicle costs that typically occur as the amount of engineering and design information advances, while unallocated contingencies are typically much broader in nature and often address changes in the project scope and schedule. Unallocated contingency is calculated as two to five percent, depending on the cost category.

5.1.3. Professional Services

This cost category includes allowances for Preliminary Engineering, Final Design, project and construction management, agency program management, project insurance, surveys and testing, and start-up costs. These allowances are computed by applying a percentage to the total construction cost estimated for each cost category (excluding right-of-way and vehicle costs). Right-of-way and vehicle costs typically are calculated to include the management and administration costs associated with these activities and are therefore excluded from the calculation of professional services.

5.1.4. Capital Costs Assumptions

Key assumptions affecting the capital cost estimates included in the financial strategy are discussed below.

The Silver Spring Transit Center, the Takoma/ Langley Transit Center, and the new south entrance to the Bethesda Metro Station, while related to the Purple Line alternatives, are funded separately and scheduled to be constructed independently and in advance of a Purple Line project. Therefore, no costs are assumed in the Purple Line capital cost estimates except for possible modifications to accommodate the Purple Line.

The expenditure for the Georgetown Branch right-of-way between Bethesda and the CSX

Metropolitan Branch, purchased previously by Montgomery County for the specific purposes of providing both a transitway and trail, is assumed to be already contributed by the County to the project.

It is also assumed that the use of roadway rights-of-way controlled by the state, counties, and local jurisdictions, including those on the University of Maryland campus in College Park and at Metro stations, would be granted to the project at no cost, except for construction of new facilities and replacement or repair of existing facilities and utilities.

The construction of the Capital Crescent Trail between Bethesda and Silver Spring is part of the Purple Line. While the design of the Purple Line includes this parallel trail, it is assumed that a separate funding program would be undertaken by Montgomery County for implementation and maintenance of the trail (e.g., local or state funding sources). The Green Trail is not part of the Purple Line and therefore would be funded separately by Montgomery County.

The capital cost estimates assume traditional design-bid-build procurement, construction, and equipping for implementing the Purple Line, although other means of project implementation could be used, such as design-build.

For reasons of construction, corridor readiness, and funding availability, the Purple Line could be implemented in stages or phases. At this point, no definitive decision has been made regarding any phasing or staging, but some possible initial phases, referred to as minimum operable segments (MOSs), could be, in no particular order or likelihood, Bethesda to Silver Spring, Silver Spring to College Park, Silver Spring to New Carrollton, or Bethesda to College Park. Any initial MOS phase would require a maintenance and storage facility.

5.1.5. Capital Cost Estimates

The cost estimates for the TSM, BRT, and LRT Alternatives are presented in Table 5-1. The table shows the increasing cost of the alternatives. This reflects the discussion of the intent and definitions of the alternatives in Chapter 2, where increased capital investment in dedicated and grade-separated alignment elements enable faster and more reliable operating speeds and travel times. In general, LRT alternatives have higher capital costs than BRT alternatives due to LRT's need for continuous track, power, and signal systems. For the High Investment Alternatives, where the BRT and LRT would have similar guideway features, such as tunnels and dedicated lanes, the cost differential between the modes narrows.

The Silver Spring/Thayer design option, being considered for the High Investment Alternatives, would cost approximately $53,600,000 less than the High Investment option for BRT, and $50,200,000 less for LRT.

The Preinkert/Chapel Drive design option being considered for the Medium Investment Alternatives would cost $10,090,000 more for BRT and $11,300,000 more for LRT.

The Medium Investment BRT variation via Jones Bridge Road, with the addition of the station at Woodmont Avenue and St. Elmo Street, would have an estimated capital cost in 2007 dollars of $597,000,000, which includes $60,000,000 for a new southern entrance at the Medical Center Metro Station, viewed as a critical element to achieve the travel time benefits for trips transferring to and from the Red Line at Medical Center. The other variation, Medium Investment BRT Extended to Medical Center with the addition of the station at Woodmont Avenue and St. Elmo Street, would have an estimated capital cost in 2007 dollars of $585,000,000 This variation could use the existing Medical Center Station entrance.

Table 5-1: Alternatives Capital Cost Estimate (2007 dollars, in millions)

Description	TSM	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
Length (miles):	16	16.9	16.8	16.8	16.2	16.4	16.5
Number of Stations:	21	22	22	21	21	21	20
Number of Revenue Vehicles:	68	60	49	42	44	44	44
Guideway and Track Elements	$10.54	$76.06	$150.57	$473.02	$307.52	$311.01	$557.71
Stations, Stops, Terminals, Intermodal	$6.23	$49.04	$82.32	$126.73	$103.12	$101.62	$157.33
Support Facilities: Yards, Shops, Admin. Buildings	$0.00	$21.60	$17.64	$15.12	$82.29	$82.29	$82.29
Sitework and Special Conditions	$3.20	$48.88	$92.81	$95.72	$86.98	$94.56	$82.48
Systems	$1.42	$29.06	$24.65	$21.23	$127.04	$126.59	$130.31
Construction Subtotal	$21.40	$224.63	$367.99	$731.82	$706.95	$716.08	$1,010.11
Right-of-Way, Land, Existing Improvements*	$3.21	$33.10	$37.10	$49.80	$58.30	$59.70	$69.50
Vehicles	$48.27	$42.59	$34.78	$29.81	$170.23	$170.23	$170.23
Professional Services	$6.85	$71.88	$117.76	$234.18	$226.22	$229.15	$323.24
Unallocated Contingency	$2.24	$14.18	$22.19	$42.87	$44.44	$44.99	$61.76
Total Project Cost	**$81.96**	**$386.39**	**$579.82**	**$1,088.48**	**$1,206.15**	**$1,220.15**	**$1,634.84**

* The proposed right-of way or easement lines generally were set 10' to 15' +/- beyond the edge of the typical section to allow for construction activity required for embankments, retaining walls and/or erosion and sediment control measures.

5.2. Operating and Maintenance Costs

5.2.1. Approach

Estimating operating and maintenance costs for an Alternatives Analysis involves two major steps: 1) development of operating plans and estimation of operating statistics for the transit mode included in each alternative, and 2) development of operating and maintenance cost models and their application to the operating statistics obtained in Step 1 to estimate the

operating and maintenance costs for the new service. The operating statistics (e.g., vehicle hours, vehicle miles) are derived from the final operating plan for each service alternative after the equilibration step in the travel demand process. Equilibration is the step whereby the supply of transit service (number of vehicles operating and passenger carrying capacity provided in a given period) is balanced with the demand (number of passengers to be carried in a given period) as estimated using travel demand models. The final operating plan describes the level of service to be provided as part of each alternative, including peak and off-peak service for weekdays and weekends.

The estimating approach used for this study conforms to the FTA's most recently issued technical guidelines for transit alternatives analysis (*Procedures and Technical Methods for Transit Project Planning: Review Draft*, September 1986 and updates), to the extent possible at this stage of the planning process. In particular, the transit cost models use the resource buildup approach methodology recommended by FTA, and the cost models are fully allocated models. This means that they test the effects of system changes (such as expansions of the rail or bus system) on costs of all areas of the agency's operation and are capable of testing different levels of costs for many individual elements of the operation, including the wages and salaries of operators and maintenance personnel, costs for fringe benefits and fuel. The models, which are derived principally using National Transit Data, follow FTA's recommended approach of separating and classifying individual expense categories.

Public transportation in the corridor is provided by a variety of transit agencies, including MTA, WMATA, and county systems operated by Montgomery and Prince George's Counties, as well as other systems such as the UM shuttle.

The resulting operating and maintenance cost estimates were validated by comparing them to actual expenditures using recent MTA bus and light rail operation statistics. Separate bus operating and maintenance cost models and estimates were developed for local and express WMATA Metrobus, the county-operated bus services, and other bus services. WMATA and county bus information were used to develop the operating and maintenance cost models for those services. The *Operating and Maintenance Cost Estimate Technical Report* documents the development of the operating and maintenance cost models and estimates, including documentation of the data sources.

The BRT and LRT Alternatives involve three elements affecting operating and maintenance costs: the costs of operating and maintaining the line haul BRT or LRT services, including vehicles; the cost of operating and maintaining the BRT or LRT facilities, including guideways, stations, and other physical components; and the changes in operating and maintenance costs from the adjustment of the local bus services along and across the corridor to reflect shifting ridership demand.

5.2.2. Operating and Maintenance Cost Assumptions

The MTA is assumed to be responsible for operation and maintenance of the Purple Line services and associated costs. MTA is also assumed to operate the additional express bus services that comprise the bulk of the additional service operated under the TSM alternative.

MTA, WMATA, Montgomery County, Prince George's County, University of Maryland, and other transit operators in the corridor and surrounding region will continue to be responsible for operations and maintenance of their bus and rail transit services and facilities, recognizing that some adjustments to service levels and routing (in the case of bus services) may result from implementation of the project.

The cost of operating and maintaining the hiker-biker trail built in conjunction with or adjacent to the Purple Line would be the responsibility of Montgomery County, the owner of the Georgetown Branch Trail.

The operating and maintenance cost estimates assume the current practice of operating and maintaining transit services would continue, although other means of operating and maintaining the services and facilities could be used.

As discussed in Section 5.1.4, *Capital Cost Assumptions*, the project could be implemented in stages or phases and have a modified operating plan.

5.2.3. Operating and Maintenance Cost Estimates

Operating and maintenance cost estimates for each alternative were determined by multiplying the unit costs by the number of vehicles, hours and miles of service, and, in the case of LRT, the one-way track miles under each option. The fully burdened cost comes from adding the costs generated by these factors as well as the factors for the BRT guideway and an add-on cost for underground stations.

Table 5-2 shows the total annual estimated operating and maintenance costs for the alternatives. Because higher capacity BRT and LRT vehicles allow the same number of passengers to be carried with fewer vehicles and fewer operators, some of the BRT and LRT alternatives have lower overall operating costs than alternatives using more conventional bus services, including the TSM alternative.

The various Build alternatives range between approximately $17 million and $26 million in cost. The costs are lower for the High Investment Alternatives, because under these alternatives the proposed BRT or LRT service would replace more of the existing bus service and the guideway bus services would operate faster and thus more efficiently, than under the Low and Medium Investment Alternatives.

Table 5-2: Total Annual Estimated Operating and Maintenance Costs (2007 dollars in millions)

Description	TSM	Low Investment BRT	Medium Investment BRT	High Investment BRT	Low Investment LRT	Medium Investment LRT	High Investment LRT
Incremental Annual Bus and BRT O&M, (including BRT Service, Station and Guideway Operation)	$14.6	$17.3	$17.3	$15.8	(-$3.6)	(-$3.6)	(-$3.6)
Incremental Annual LRT O&M, Service, Station and Guideway Costs	-	-	-	-	$30.0	$28.6	$25.8
Total Annual O&M Cost Increase over No Build	**$14.6**	**$17.3**	**$17.3**	**$15.8**	**$26.4**	**$25.0**	**$22.8**
Annual Change in Systemwide Farebox Revenue	$2.4	$3.3	$4.5	$5.2	$5.3	$5.6	$6.2
Annual Operating and Maintenance Subsidy	$12.2	$14.0	$12.8	$10.6	$21.1	$19.4	$16.0

The Silver Spring/Thayer Avenue and Preinkert/ Chapel Drive design options would have no appreciable difference in operating costs from the alternatives for which they are being considered.

The Medium Investment BRT variation via Jones Bridge Road, would have an estimated operating and maintenance cost in 2007 dollars of $17,300,000, which is the same as the basic Low and Medium Investment BRT alternatives while the other variation, Medium Investment BRT extended to Medical Center, would have an estimated capital cost in 2007 dollars of $18,300,000.

5.2.4. Farebox Revenues

Farebox revenues are those that are collected from passengers using the transit services for making trips. People use a variety of means to pay fares, including cash, tokens, passes, and electronic farecards. Passes and farecards for multi-trip, or weekly and monthly periods are typically purchased at a discount. Fares revenues include both fares at the initial boarding of the trip as well any transfer costs. For the purposes of this analysis, the operator of the Purple Line would be the MTA.

With the increase in systemwide transit users forecasted for the alternatives, the increase in systemwide farebox revenues relative to the 2030 No Build are presented in Table 5-2.

5.2.5. Operating Subsidy

Annual operating and maintenance costs in excess of the annual farebox revenues would require a subsidy from some combination of state and local sources. Table 5-2 shows the forecasted annual operating subsidies for each of the alternatives.

5.2.6. Financial Strategy

This section summarizes the current strategy for funding and financing a project that may emerge from this Alternatives Analysis. It provides background information regarding transportation revenue and expenditures in Maryland, and places the project in the context of the state's transportation budgeting and capital planning process. The portion of the Purple Line between Bethesda and Silver Spring (the earlier Georgetown Branch Transitway/Trail Project) is included as a project in the MWCOG Constrained Long Range Plan (CLRP). The portion between Silver Spring and New Carrollton is defined as a study. The State Transportation Improvement Program/ Consolidated Transportation Improvement Plan (STIP/CTP) includes funding for ongoing planning through 2010 for the Purple Line.

5.2.7. Transit Funding In Maryland

The MTA is unusual as a transit agency in that it is part of the Maryland Department of Transportation (MDOT) and the non-federal share of transit expenditures, both capital and operating, is funded by the State. Transit is one of several modes that are funded using the Maryland Transportation Trust Fund (TTF). The TTF was created in 1971 to provide a dedicated source of revenues to support state transportation. The fund supports all of the department's activities, including debt service, modal agency operations, and capital projects.

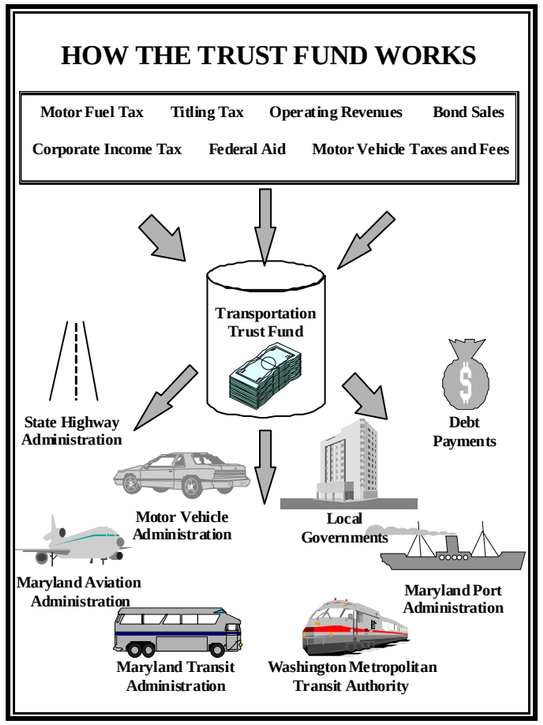
All state revenues for transportation are collected through the TTF, including taxes, user fees and charges, bond proceeds, federal aid, and operating receipts. Highway toll revenues are collected by the Maryland Transportation Authority.

Several sources of revenues make up the TTF. They include the following:

- Motor vehicle fuel taxes of 23.5 cents per gallon of gasoline, 24.25 cents per gallon of diesel fuel, and 7 cents per gallon of aviation fuel
- Motor vehicle registration and other fees
- Motor vehicle title tax of 5 percent of the fair market value of new and used vehicle sales and those of new residents
- Corporate income tax – 21 percent of the State's 7 percent corporate income sales tax
- Beginning in 2009, 6.5 percent of the 6 percent state sales and use tax will be dedicated to the TTF and is estimated to be $1.6 billion over the 6-year period covered by the MDOT capital program
- Operating revenues from transit fare boxes, Maryland Port Authority terminal operations, Maryland Aviation Administration flight activities, fees, parking, and concessions
- Federal funds – authorized by the U.S. Congress. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation authorized $720 million in annual funds to MDOT, $580 million in highway programs and $140 million in transit funds.

The TTF is predominantly comprised of motor vehicle and other user fees. These offer a stable source of revenue for MDOT, a source that consistently grows at a modest rate each year. However, because the motor vehicle fuel tax is a flat fee, rather than charged as a percentage of retail prices, revenues from that source do not grow with inflation. Figure 5-1 shows how the TTF works.

Figure 5-1: Transportation Trust Fund Overview



Allocation of TTF funds is determined by the Maryland Secretary of Transportation and approved by the Governor and the Maryland General Assembly. A target fund balance of $100 million is maintained to provide for MDOT's working cash flow requirements.

Maryland is considering a number of major transit capital investments in addition to the Purple Line, including the Red Line Corridor in Baltimore, the Corridor Cities Transitway in Montgomery County, and a major MARC expansion (the commuter rail system in Maryland serving the Baltimore-Washington area). In addition, high priority is being given to

existing transit system preservation and rehabilitation. Along with transit needs, substantial funding needs exist for highways and other transportation systems supported by the TTF, which will require decisions regarding revenue increases for the TTF, other sources of revenue, and prioritization regarding the scale and timing of the transit projects.

Figure 5-2 illustrates the annual TTF revenue from 1988 to 2007. The last time the 23.5 cent per gallon gas tax was raised in Maryland was 1992. Revenues in the TTF, although growing at a relative steady rate, were simply not keeping up with the State's transportation needs. An increase in motor vehicle registration and titling fees in 2004 helped replenish trust fund revenues starting in FY 2005. However, even with these increases, estimates by MDOT projected a potential $1.5 billion transportation-funding shortfall by 2008 and a $40 billion shortfall over the next twenty years. This projected shortfall is attributed in particular to growth in the transportation system and system demand, as well increased needs for maintenance to the aging existing infrastructure, including bridges, roads, and transit rolling stock and facilities.

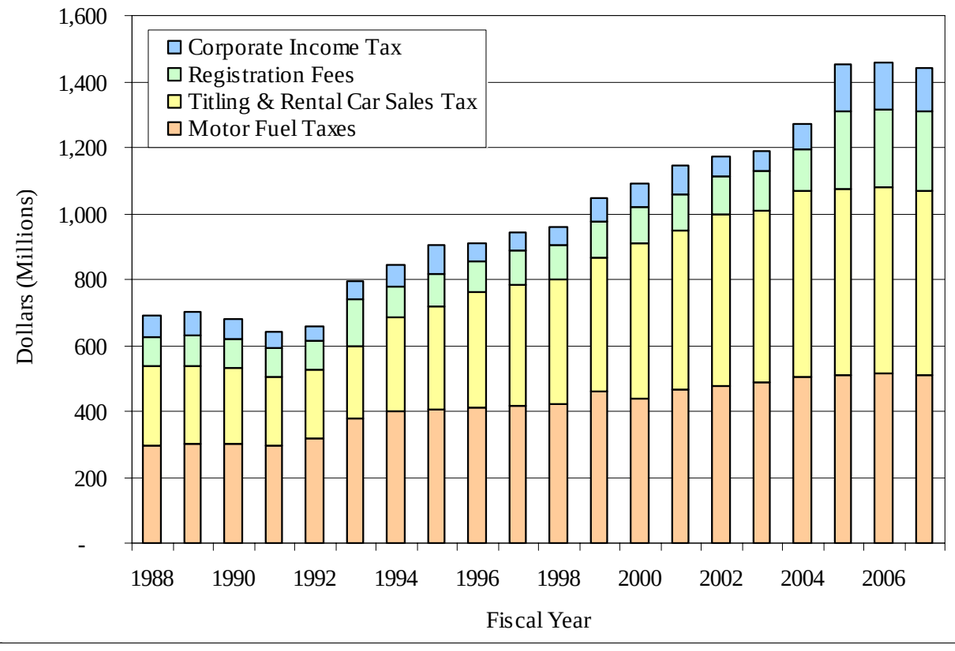
In a Special Session of the Maryland General Assembly held in late 2007, the General Assembly passed and Governor O'Malley signed a combination of revenue enhancements that increased TTF revenues by more than $400 million a year. These funds have been programmed in the 2008 Consolidated Transportation Program (CTP) that allocates funding to capital projects for FY 2008–2013. A substantial portion of the revenue increase was dedicated to the Maryland transit program. The Purple Line received a commitment of $100 million of the revenues from the increase in the FY 2008–2013 CTP. This money should be sufficient to take the project through completion of Preliminary Engineering and into Final Design.

Historically, transit has received approximately 35 percent of the TTF over a given six-year capital program. In FY 2007, transit accounted for 25.3 percent of the TTF expenditures with 18.6 percent allocated to MTA and 6.7 percent allocated to WMATA.

Given the State's growth plan for transit in Maryland, including consideration of implementation of three major capital investment projects (the Purple Line, the Corridor Cities Transitway, and the Red Line Corridor), the MDOT is developing a plan that combines the staggering and phasing of projects with a program to capture additional revenues from local governments. The intent is to have funds available to meet capital and operating costs of the New Starts projects, as well as a range of additional system enhancements to improve system preservation and operations of the existing transit system and its general operating obligations.

This strategy is in the process of being developed by MDOT, along with a specific plan to implement it. Once the details of the revenue enhancements are available and decisions are made regarding the specific levels of investments in the various corridors, MTA would specify an exact plan for funding this project. Once that information is available, MTA would develop a strategy for funding this project through construction, ensuring the availability of funds for operating this new investment while maintaining the quality of operations and maintenance for the remainder of its transit systems.

Figure 5-2: Transportation Trust Fund Revenue Increase Strategy



Beyond state funds, the remainder of the funding would come from federal, county, and possibly private-sector sources. It is expected that Montgomery and Prince George's Counties would provide capital funds for construction of the Purple Line in addition to right-of-way contributions, easements, and ancillary roadway and trail facilities.

5.2.8. Montgomery County Funding

Montgomery County is a member jurisdiction of WMATA through the Washington Suburban Transit Commission (WSTC). The WSTC was created in 1965 by the General Assembly of Maryland and the Transit Authority through an interstate compact among Maryland, Virginia, and the District of Columbia, with the consent of Congress in 1967.

WMATA provides Metrobus and Metrorail service to Montgomery County, as well as the remainder of the Washington region. Mass transit has become an integral part of the transportation network of the county with present services provided via a number of Metrobus routes and Metrorail Red Line.

In 1980, the federal legislation authorizing funding for the Metrorail system required the local governments in the Washington region to develop a "stable and reliable" source of funding for the local costs required to build and operate mass transit systems. Montgomery County satisfied that requirement because it had already, in 1965, established a Mass Transit Facilities Fund that receives revenue from both a county real estate tax dedicated to transit, and state aid.

Proceeds from the local property tax are currently the main source of funding for the mass transit program which goes to funding local bus service, including Ride On bus service, and the

county's local share of WMATA's capital and operating costs, bus operations, rail operations, and debt service.

5.2.9. Prince George's County Funding

Prince George's County is also a member jurisdiction of WMATA through the WSTC. Like Montgomery County, Prince George's County, in 1982, established a mass transit special revenue fund which receives revenues from the state real property tax grant revenue sharing program. Additional county funding is also provided through its general fund.

Proceeds from the local property tax are currently the main source of funding for the mass transit program which goes to funding local bus service, including TheBus, and the county's local share of WMATA's capital and operating costs, bus operations, rail operations, and debt service.

5.2.10. Potential Private-Sector Funding

The private sector is a potential source of funding, especially in areas that are undergoing land development changes or expected to in the future, especially in concert with the possible Purple Line Locally Preferred Alternative. The Federal Transit Administration (FTA) has adopted policies that give special interest and preference to transit projects involving private sector participation. This includes station area joint development projects and private value capture financing techniques to assist in funding the capital or operating and maintenance costs of transportation improvements. Joint development is any development that is physically or functionally related to transit station areas. Value capture is the technique or mechanism used to "capture" a portion of the incremental value created on land and improvements associated with the transit system.

MDOT, WMATA, Montgomery County, and Prince George's County have recent experience in both joint development and value capture mechanisms. Specific policies and value capture mechanisms utilized by MDOT include leasing of transit agency-owned land for air rights development; right-of-way contributions; developer "in-kind" contributions; and space lease arrangements. WMATA derives significant value capture revenues through leasing transit-owned property for air rights development and has also obtained limited revenues through developer cost sharing arrangements and connector fees. Montgomery County and Prince George's County have many of the zoning and policy tools in place to promote station area development (i.e., transit district overlay zone process) and is experienced in determining the pro rata share of the cost for off-site facilities that developers must proffer in transit districts.

A variety of joint development and value capture mechanisms offer the potential to contribute to the capital and operation and maintenance and funding of the Purple Line.

Transit District Overlay Zone (TDOZ) – This mechanism has been established in Montgomery County and Prince George's County to promote coordinated and integrated development schemes around transit stations through the District Overlay Zoning process. A designated transit districts includes specific land uses and densities for areas around transit stations including the distance from the station locations.

Right-of-Way Contributions – This category includes the contribution of privately- or publicly-owned land that is needed for the transit improvement's right-of-way, station areas, or support facilities.

Developer Dedication/Proffers – This category includes the amount developers might be willing to pay for off-site facility improvements associated with transit station area development. The amount of potential proffers is based upon the increase in residual land value that is expected to occur as zoning allows developers to build at a higher density than would otherwise occur.

Developer Payment in Lieu of Parking – This mechanism involves reducing parking requirements, often by approximately one space per 1,000 square feet of commercial office development at station areas. Payments in lieu of parking are usually negotiated on a case-by-case basis with developers and include a fairly complex formula for determining the cost benefit of a parking reduction. At the King Street Metrorail Station in Alexandria, the City, for example, has required developers to make payments to the City in the amount which effectively equates to about two-thirds of the cost savings.

Benefit Assessments – This value capture mechanism focuses on commercial development within transit station areas and assumes that the transit system will have a positive effect on achievable lease rates as market image is enhanced and tenant demand rises. The value capture works on the premise that the increased value created by induced lease rates is split between the transit agency or local jurisdiction and the developer through the establishment of a benefit assessment tax, which would likely be assessed on a per-square-foot basis of commercial floor area.

Air Rights Development Revenues – Air rights revenues include ground lease revenues, developer dedication/proffers, payments in lieu of parking, and benefit assessments (as described previously).

While there are no committed sources or amounts of capital or operating and maintenance funds support from these private sector sources, the MTA, Montgomery County, Prince George's County, and the Maryland-National Capital Park and Planning Commission will continue to look for private sector funding opportunities.

Private-sector funding contributions would most likely come from development projects adjacent to certain Purple Line stations, particularly Bethesda (existing Metrorail Station), Connecticut Avenue at the Georgetown Branch right-of-way, Silver Spring Transit Center (existing Metrorail/MARC Station), Fenton Street, Arliss Street, Takoma-Langley Transit Center, University of Maryland – East Campus, College Park (existing Metrorail/MARC station), River Road, and New Carrollton (existing Metrorail/MARC/ Amtrak station). Contributions are typically targeted toward stations and enhancements along the alignment.

5.2.11. Federal Aid

The U.S. Department of Transportation is a prime source of funding major transportation infrastructure construction, especially for interstate highways and transit. The principal source for transit is the FTA's New Starts program discussed below. A number of other federal programs have the potential to provide some funding for enhancements and associated components of a Purple Line Locally Preferred Alternative and will be explored further once the Locally Preferred Alternative is selected.

New Starts

The FTA's discretionary Section 5309 New Starts program is the federal government's primary financial resource for supporting locally planned, implemented, and operated major transit capital investments. The New Starts program funds new, and extensions to existing, fixed guideway systems, including commuter rail, light rail, heavy rail, BRT, trolleys, and ferries. For the five-year period FY 2005 - FY 2009, the

New Starts program is authorized at $7.4 billion ($1.5 billion per year average). The New Starts program is funded at about 16 percent of the total federal transit funding for FY 2005 – FY 2009 ($45.3 billion). To qualify for federal funding, New Starts projects must be authorized by the U.S. Congress in the Surface Transportation Authorization Act, which occurs every five or six years. The current authorization act (SAFETEA-LU) is in effect through FY 2009. The allocation of federal funds for specific transit New Starts projects occurs in the annual Transportation Appropriations Act. Congress earmarks transit New Starts discretionary funds to various projects throughout the country. The bulk of projects that obtain federal transit discretionary funding earmarks are those projects that are in FTA's Full Funding Grant Agreement (FFGA) process. In fact, FTA's FY 2007 budget request to Congress includes $1.228 billion (92 percent of the total request) for New Starts projects in the FFGA pipeline and $102 million for other projects (8 percent).

Due to intense competition for federal transit funding, the federal share for New Starts projects has steadily declined over the past 10 years. Although the law allows an 80 percent federal share for New Starts projects, the trend has been to limit federal funds to around 50 percent. Funding for transit projects in Maryland is an excellent example of this change in that the original Washington Metrorail system received 100 percent federal funding. When the Baltimore Metro was built, it received 90 percent federal funding. In the 1990s when the Baltimore Central Light Rail Line Phase 2 was built, it received 80 percent federal funding, while the recently completed Largo extension of the Metrorail received 60 percent federal funding. Because requests for this funding assistance far outstrip the available funds, projects from around the country compete against each other for funds. In recent fiscal years, the Congressional Appropriation Committee has been limiting the federal share to 50 percent and nearly all project requests for federal assistance are in this range.

For transit projects seeking federal funds, the agency sponsoring a locally selected transit project submits a "New Starts Criteria" package to FTA to get the project into the "funding pipeline." This package is first developed after the Alternatives Analysis is completed and a Locally Preferred Alternative is selected, prior to the request to enter the Preliminary Engineering phase. The package provides information describing the proposed project and information about a number of criteria used to rate the project against other projects from around the country competing for the limited pool of New Starts funds. These criteria include the following:

- Mobility improvements (travel time savings, low-income households served)
- Environmental benefits
- Operating efficiencies (operating cost per mile)
- Cost-effectiveness (transportation system user benefits)
- Transit-supportive land use patterns, policies, and programs
- Local financial commitment
- Economic Development

Under SAFETEA-LU (August 2005), a five level scale of "High," "Medium-High," "Medium," "Medium-Low," and "Low" is established for overall project rating, as well as for individual criteria. Only those projects rated "Medium" or higher, overall, may be advanced through the New Starts project development process or be recommended for funding. A "Medium" overall rating requires a rating of at least "Medium" for both project justification and local financial commitment, and if a project receives a "Low" rating for either project justification or local financial commitment, it will receive a "Low" overall rating. FTA further notes that it will not generally recommend for funding any project that does not achieve a rating of at least "Medium" for cost effectiveness. A project must receive an overall rating of at least "Medium" to be admitted into Preliminary Engineering or Final Design, or to receive a funding recommendation. FTA no longer rates projects as Highly Recommended, Recommended or Not Recommended for funding. Projects must still go through the administrative and political steps of the Executive and Congressional budget and appropriations processes.

Another key variable is the local financial commitment, which focuses on the availability and reliability of local funding sources for capital construction and operating and maintenance costs, as well as the overall amount and share of project cost being requested from the federal Section 5309 program. Maryland has historically rated very well in these areas.

A project emerging out of an Alternatives Analysis phase with a selected Locally Preferred Alternative that is in the state's CLRP is eligible to submit a "Request to Initiate Preliminary Engineering." During the Preliminary Engineering phase, the project will complete detailed planning and conduct Preliminary Engineering, complete the federal and state environmental review processes (environmental impact statement), and prepare project management and financial plans. At the completion of the Preliminary Engineering phase, the New Starts Criteria package for the project is updated and submitted for rating and recommendation. After receiving a New Starts rating from FTA, the project would submit a "Request to Initiate Final Design." In this phase, final construction plans are developed, and property acquisition and construction and equipment procurement occur that eventually lead to the start of operations. A key element of this phase is negotiating an FFGA between the sponsoring agency and FTA regarding the amount and payout schedule for the federal share of funds.

The Purple Line, Red Line Corridor, and the Corridor Cities Transitway are potential New Starts projects. None of these projects has selected a Locally Preferred Alternative, and therefore have not yet submitted a New Starts Criteria package to FTA for rating. Since these projects have not been rated, they are not officially in the New Starts pipeline and have yet to submit a "Request to Initiate Preliminary Engineering." The Purple Line and the Red Line Corridor Transit Study are in the Alternatives Analysis phase, and the Corridor Cities Transitway project is at the stage of updating its environmental documentation and, subsequently, selecting the Locally Preferred Alternative for the transit component of the project. All have entered the federal environmental process, NEPA.

The current SAFETEA-LU authorizing legislation expires in FY 2009, at which time it is expected that a successor authorizing legislation would be passed by Congress and signed into law. The candidate Maryland New Starts projects, including the Purple Line, would be seeking capital funding authorized in this successor legislation.

5.2.12. Capital Funding Strategy

A number of decisions will affect the amount and timing of the funding required for building and operating the Purple Line. First is the decision on the Locally Preferred Alternative, which will establish the overall level of capital funding needed. It is possible that the Locally Preferred Alternative may be a modification of an alternative considered in this AA/DEIS in terms

of location of the terminal stations, the number and location of stations, and other components of the project definition. The other decision is the timing of the construction and start of operations, including initiation and phasing or staging of construction. Major influences on the timing will be the availability of funding, especially the state funding, and the state priorities relative to the other New Starts projects.

MDOT will seek New Starts funding for the Locally Preferred Alternative. While up to 80 percent of the project costs can be covered by the New Starts program, it is expected that MDOT will be seeking between 50 and 60 percent. The majority of the non-New Starts funding is expected to come from the Maryland TTF. Capital fund contributions, above right-of-way and related property and easement contributions are expected from Montgomery County, particularly for the Capital Crescent Trail along the Georgetown Branch right-of-way and Prince George's County. Non-New Starts federal funding will be sought for various enhancements, such as trails, and roadway, railroad and transit oriented development improvements, where eligible.

The MTA will aggressively pursue private sources of funding. At a number of station areas, there is the potential for developer contributions for stations and the adjoining area, specifically at Bethesda (existing Metrorail Station), Connecticut Avenue at the Georgetown Branch right-of-way, Silver Spring Transit Center (existing Metrorail and MARC Station), Fenton Street, Arliss Street, Takoma/Langley Transit Center, University of Maryland – East Campus, College Park (existing Metrorail and MARC station), River Road, Kenilworth Avenue, and New Carrollton (existing Metrorail, MARC and Amtrak station).

As discussed earlier, a special session of the Maryland Legislature enabled a number of revenue enhancements that include a $400 million per year increase in revenue to the TTF in late 2007. In January 2008, the Governor announced that $100 million was committed to the Purple Line. The Red Line in Baltimore also received a commitment of $100 million and the Corridor Cities Transitway received $80 million.

As the additional funds were just recently added to the CTP, the Purple Line and Corridor Cities Transitway funds will be included in next update of the Washington region financially constrained long-range regional transportation plan.

The FY 2008–2013 MDOT Consolidated Transportation Program (CTP) has a total of $87,698,000 in funds for the Purple Line Corridor project, including $10,826,000 in Federal Aid. The CTP shows funds by both category of expense and year of expenditure through 2013. The CTP is updated every year for all projects within the program. The FY 2008-2013 CTP shows funds for planning/ NEPA/Preliminary Engineering through FY 2010 and Final Design funds through 2013. Funding for Final Design beyond 2013 and right-of-way and construction would be in future years. Since a Locally Preferred Alternative has not been selected, these funds are essentially being held in place, pending selection of an alternative. Should No Build be selected, any unspent funds revert back to the TTF. Should a TSM or Build alternative be selected, the funds by category and year of expenditure will be adjusted annually to reflect the scope and cost of the project, federal funds anticipated, and project schedule. The state funds allocated to the Purple Line are based on a six-year revenue projection for the entire TTF, calculated by MDOT, for purposes of assigning funds to the entire MDOT Capital Program.

It is expected that a further funding revenue increase will be pursued over the next several years to fund the priority transit projects in Maryland, including system preservation, MARC improvements, and the selected New Starts projects' Locally Preferred Alternatives. While one possible scenario is to increase revenue to the Maryland TTF, other jurisdictional or institutional revenue and funding mechanisms are possible, such as special transit improvement districts, or local option funding. It is expected that funding for the Purple Line Locally Preferred Alternative and other priority New Starts projects will be in place by 2011.

5.2.13. Operating and Maintenance Cost Funding Strategy

As is the case for existing MTA services, should the MTA operate the Purple Line, that portion of the annual operating and maintenance and associated costs not covered by fare revenues, i.e., the operating subsidy (Table 5-2), would be funded by the TTF. As part of the State-level revenue enhancement for capital funding, other sources and mechanisms for providing the operating subsidy may be considered, including possible county contributions.

5.3. Cost and Funding Conclusions

The capital cost funding and annual operating cost subsidy for the Purple Line would be funded from a package of federal, state, county, and possibly private sources. It is expected that 50 to 60 percent of the capital funding will be sought from the federal New Starts funding. While other federal, county, and private sources will contribute to the remainder of the capital funding needs, the State of Maryland would be the principal source. Recent revenue increases and programmatic commitments will cover the funding need for design and initial capital costs. It is expected that further revenue increases and funding mechanisms will be in place by 2011 to fund the implementation and operations of the Purple Line Locally Preferred Alternative.

Chapter 6
Evaluation of Alternatives

Chapter 6. Evaluation of Alternatives

6.1. Approach

This chapter draws on the information and analyses presented in the previous chapters and features an evaluation framework involving the following:

- Effectiveness – the extent to which an alternative accomplishes the purposes that the transportation improvements are intended to address
- Cost-Effectiveness – the extent to which an alternative provides a level of benefits that is commensurate with its costs (and relative to other alternatives)
- Financial Feasibility – the extent to which sufficient funding is available or can be developed to support the construction, operation, and maintenance of an alternative
- Equity – the extent to which each alternative provides fair distribution of costs and benefits across various communities in the corridor

This evaluation framework is designed to support decision-making for the Washington metropolitan area, the State of Maryland, and the Federal Transit Administration (FTA), as it is expected that federal funding would be sought if one of the Build alternatives is selected for implementation. It has been followed in the belief that it provides both the quantitative and qualitative material needed for decision-making by a variety of groups in a manner that will successfully build a consensus among all concerned with selection and implementation of a Locally Preferred Alternative.

As presented in Chapter 1, improvements to the transportation system in the corridor need to address the following transportation challenges:

- Increasing congestion on the roadway system
- Slow and unreliable transit travel times on this congested roadway system
- Limited travel mode options for east-west travel
- Degraded mobility and accessibility between major activity centers and residential areas
- Degraded transit accessibility to the larger metropolitan region due to inferior connections to radial Metrorail lines and to other rail and bus services

Through extensive community and stakeholder outreach and the AA/DEIS technical analyses, a set of objectives and evaluation measures were developed for use in selecting the preferred transit investment in the corridor. These efforts identified that the consideration of transit improvements in the corridor was driven by factors beyond just mobility, accessibility, and transit operating efficiencies to include support of economic and community development, environmental quality and optimizing public investment. These can be summarized as follows:

- Increase mobility and improve accessibility
- Improve transit operations efficiencies
- Enhance environmental quality
- Optimize public investment
- Support local plans for economic and community development
- Support attainment of regional air quality standards

6.1.1. Federal New Starts Criteria Considerations

As discussed in Chapter 5, it is expected that FTA funds would be sought if one of the Build alternatives is selected for implementation. The study goals and objectives in part reflect the evaluation criteria established by the FTA for potential projects eligible for funding under the New Starts process. This is a competitive process whereby communities across the country compete for federal funding in starting new transit projects. The federal criteria and measures related to justifying the project are listed in Table 6-1.

In addition to the criteria above, the FTA considers the community's capacity to finance the proposed project. FTA has established a number of measures that help to assess financial capacity, including the following:

- Stability and reliability of capital financing plan
- Stability and reliability of operating financing plan
- Local share of proposed costs

The issue of financial capacity is not directly applicable to the evaluation of the merits of the specific alternatives and ranking one alternative above another; however, it can affect the decision on the overall affordability of an alternative if the cost of construction or operations and maintenance exceed likely available financial resources. It underscores the importance, as expressed in the project justification criteria related to operating efficiency and cost-effectiveness, of minimizing the costs of the alternatives relative to the transportation benefits they provide to the region.

6.2. Attainment of Goals and Objectives

A series of objectives were developed to support the goals described in Chapter 1 and summarized in Section 6.1. The objectives were based on FTA New Starts guidelines and recommendations from local agencies, stakeholders, and members of the public. The means of assessing how well the various alternatives do (or do not) meet the goals include a mix of quantitative measures of effectiveness and cost effectiveness, and qualitative

Table 6-1: FTA Project Justification Criteria and Measures

New Starts Criteria	Measures
Mobility Improvements	Travel Time Savings Transit Dependent Households Served
Environmental Benefits	EPA Air Quality Designation
Operating Efficiencies	Operating Cost per Passenger Mile
Cost-Effectiveness	Incremental Cost per Hour of Transportation System User Benefits Incremental Cost per New Rider
Transit-Supportive Land Use and Future Patterns	Existing Land Use Transit-Supportive Corridor Policies Performance and Impacts of Land Use Policies
Other Factors	Project Benefits not Reflected by Other New Starts Criteria

Source: New Starts: An Introduction to FTA's Capital Investment Program. US Department of Transportation, Federal Transit Administration.

assessments. The sources for these measures were MDOT/MTA, FTA New Starts Criteria, county and local jurisdictions and agencies, and corridor-specific needs and issues. The key measures, especially those that contribute substantially to differentiating among alternatives, are summarized in Table 6-2. This table presents information presented in the previous chapters. Some quantitative information presented in previous chapters is rounded here in order to simplify the presentation. In the sections that follow this information is discussed in regard to effectiveness, cost effectiveness, financial feasibility, and equity.

Table 6-2: Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure		No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Increase Mobility and Improve Accessibility										
• Improve accessibility to existing and planned economic development areas in the corridor • Improve access to jobs in corridor • Increase employers' access to labor pool	• User Benefits by Alternatives, 2030 (daily minutes)		--	401,200	623,700	851,200	994,200	1,033,700	1,098,200	1,211,8000
	• Percent over TSM		--	--	56%	112%	148%	158%	174%	202%
	• User Benefits with Mode-Specific Attributes by Alternatives, 2030 (daily minutes)		--	401,200	702,300	1,022,200	1,258,000	1,180,600	1,303,800	1,489,600
	• Percent over TSM		--	--	75%	155%	214%	194%	225%	271%
	• Accessibility of residents to employment: jobs within ¼ to ½ mile of stations		All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor among the alternatives.							
	• Accessibility of employers to workers: households within ¼ to ½ mile of stations									
• Reduce travel time between activity centers:		Current								
o Bethesda – Silver Spring		20	35	33	25	19	19	12	9	9
o Bethesda – Takoma/Langley Park		38	65	61	51	38	33	29	26	23
o Bethesda – UM Campus Center		49	81	76	66	49	40	38	34	30
o Silver Spring – Takoma/Langley		19	31	29	26	19	14	18	17	14
o Silver Spring – Riverdale Park		44	67	62	59	43	33	39	38	32
o Silver Spring – UM Campus Center	• Peak transit travel times for alternatives in 2030 (minutes)	29	47	44	41	30	22	26	25	21
o Silver Spring-College Park Metro		36	56	53	52	36	28	32	31	27
o Takoma/Langley – Riverdale Park		25	36	34	33	24	19	22	22	19
o East Silver Spring – Silver Spring		5	8	8	8	7	5	7	7	4
o East Silver Spring – Takoma Langley		14	23	21	19	13	10	11	11	10
o New Carrollton – Riverdale Park		11	15	12	13	13	10	13	13	10
o New Carrollton – University of Maryland		25	35	30	31	25	21	25	25	21
o New Carrollton – Silver Spring		54	81	73	72	55	43	51	50	42
• Improve mobility for transit-dependent households	• Number of zero-car households within ¼ mile of stations		All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor among the alternatives.							

Table 6-2: Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure	No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Improve Transit Operations Efficiencies									
• Increase interconnectivity of transit system, including bus-to-bus and bus-to-rail transfers	• Number of routes connecting at major transfer points	All alternatives have very similar station locations and connectivity to other transit services. Therefore, this connectivity measure is not a differentiating factor among the alternatives.							
• Integrate radial Metrorail and MARC lines for better transit system connectivity (also see below under Increase regional transit usage)	• Transfer walk time • Number of transfers required to access major activity centers	All alternatives have very similar service plans and station locations. Therefore, these transfer measures are not a differentiating factor among the alternatives, except that the BRT alternatives provide better connectivity with the existing bus facility at the Bethesda Metro Station.							
• Increase reliability of transit service	• Comparison of running way characteristics (miles):								
	o Dedicated	All shared	All shared 15.97	0.67	7.4	7.71	8.62	9.18	8.88
	o Exclusive			1.97	4.85	9.37	5.73	5.74	8.81
	o Shared (with traffic)			14.43	4.68	0.15	1.76	1.33	0.16
	• Comparison of vertical alignment type (miles):								
	o Aerial	All surface running	All surface 15.97	--	1.26	1.63	1.06	1.06	1.73
	o Surface			17.07	15.66	12.99	14.39	14.5	12.9
	o Tunnel			--	0.01	2.61	0.66	0.69	3.22
• Increase regional transit usage • Integrate radial Metrorail and MARC lines for better transit system connectivity	• Transit ridership (daily boardings)								
	o Purple Line	--	14,800	22,200	29,300	33,800	32,500	33,900	36,100
	o Purple Line via Metrorail	--	2,100	16,700	21,100	23,700	25,300	27,200	30,500
	o Purple Line via MARC	--	--	1,100	1,400	1,400	1,500	1,500	1,500
	Total	--	16,900	40,000	51,800	58,900	59,300	62,600	68,100
	New transit trips relative to No Build	--	8,200	11,400	15,300	17,700	18,200	19,200	20,500
	Percent new trips relative to No Build	--	--	14%	25%	29%	31%	32%	35%
• Reduce transit travel times in the corridor	• Change in operating speeds of transit service	--	9	10	13	16	15	16	19
	• Change in travel time between major activity centers	See objective “reduce travel time between activity centers” above.							
	• End-to-end peak period running times Bethesda to New Carrollton (minutes)	--	108	96	73	59	62	59	50
• Serve transit-oriented populations	• Number of zero-car households within ¼ and ½ mile of stations	All alternatives have very similar alignments and station locations. Therefore, these accessibility measures are not a differentiating factor between alternatives.							

Table 6-2: Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure	No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Enhance Environmental Quality									
• Minimize and mitigate impacts to the natural and human environment in the corridor • Provide a safe and attractive transit service that is compatible with local community character	• Direct impacts to natural resources	• All alternatives have very similar alignments and station locations, and as a result, the natural environment impacts are not appreciably different between alternatives. The Build alternatives would impact between 1 and 1.4 acres of wetland, 13.5 to 15.1 acres of floodplains, and 3,892 to 5,719 linear feet of stream.							
	• Direct impacts to parklands	• Up to 11 parks, five open space areas (schools) and five trails, could potentially to be impacted by a Build Alternative. • Individual park impacts are all less than an acre. Total impacts from the Build alternatives range from 1.98 acres for Low Investment LRT to 3.02 acres for Medium Investment BRT. • Individual open space (public school) impacts range from 0.05 acre to 1.65 acres except for impacts to the University of Maryland, which range from 7.02 acres to 13.91 areas. Total impacts to open space from the Build alternatives range from 7.38 acres for Medium Investment BRT Preinkert/Chapel Drive design option to 14.46 acres for Low Investment BRT. • Individual trail impacts range from 0.02 acre to 1.67 acres. Total impacts from the Build alternatives range from 1.29 acres for High Investment BRT Silver Spring/Thayer Avenue design option to1.85 acres for Medium Investment LRT.							
	• Direct impacts to historic properties	• All BRT and LRT alternatives except Low Investment BRT could impact one historic standing structure resources, the Falkland Apartments.							
	• Visual effects.	• All alternatives have nearly identical alignments and station locations and result is similar visual effects, with the most substantial visual effects being along the Georgetown Branch right-of-way. The Preinkert/Chapel Drive and Silver Spring/Thayer Avenue design options would present additional substantial visual effects.							
	• Direct residential property impacts (number of displacements)	• All of the Build alternatives require residential displacements. • Low Investment BRT has the fewest displacements (three single-family homes) while the High Investment BRT and LRT alternatives have the most residential displacements (ten single-family houses, several units from three buildings of two apartment complexes, and one duplex).							
Optimize Public Investment									
• Demonstrate that the overall benefits of the transit improvements warrant their capital and operating costs	• Total capital cost ($2007 in million)	--	$82	$386	$580	$1,088	$1,206	$1,220	$1,635
	• Annual operating and maintenance costs ($2007 in millions)	--	$14.6	$17.3	$17.3	$15.8	$26.4	$25.0	$22.8
	• Annual increase in operating subsidy ($2007 in millions)	--	$12.2	$14.0	$12.8	$10.6	$21.1	$19.4	$16.0
	• FTA cost-effectiveness measures (cost per hour of User Benefit)	--	--	$18.24	$14.01	$19.34	$26.51	$22.82	$23.71
	• Annualized cost per new rider relative to No Build	--	$8.98	$14.49	$14.29	$19.76	$22.96	$21.72	$24.57

Table 6-2: Summary of Key Evaluation Measures for Alternatives

Objective	Evaluation Measure	No Build	TSM	Low Investment BRT	Med Investment BRT	High Investment BRT	Low Investment LRT	Med Investment LRT	High Investment LRT
Support Local Plans for Economic and Community Development									
• Support local, regional, and state policies and adopted master plans	• Consistency with local, regional, and state policies and adopted master plans	• Only the LRT alternatives support the Montgomery County Master Plan, which calls for LRT between Bethesda and Silver Spring, with a trail along the Georgetown Branch right-of-way. All Build alternatives would support the Montgomery County Master Plan by constructing the permanent Capital Crescent Trail, although the Low Investment BRT alternative would not build the permanent trail west of Jones Mill Road. The Prince George's County Master Plan supports the Purple Line in general, but does not identify a specific alignment. Both Montgomery and Prince George's Counties are in the process of developing functional master plans for the Purple Line.							
• Support potential for transit-oriented development at existing and proposed stations in support of local land use plans	• Number and size of transit-oriented development opportunities • Potential for new development	• All alternatives have nearly identical alignments and station locations and similar volumes of service. Therefore, these development measures are not a differentiating factor among the alternatives except Low Investment BRT, which would not support the planned transit oriented development at Chevy Chase Lake. High Investment BRT and LRT would not have a station at Fenton Street, would therefore not support transit-oriented development at this location.							
Support Attainment of Regional Clean Air Goals									
• Support attainment of regional air quality goals	• Change in regional emission burden	--	All alternatives produce small but beneficial changes in regional emissions						

6.3. Effectiveness

6.3.1. Increase Mobility and Improve Accessibility

The corridor has four major activity centers, Bethesda, Silver Spring, College Park, and New Carrollton, each with a substantial employment base and surrounding residential concentration and each with a Metrorail Station. Other key activity centers are the University of Maryland campus with 36,000 students and 12,000 employees, and the Takoma Park/Langley Park area. The corridor is fully developed with residential communities of varying income levels. They all share a characteristic of relatively high transit usage and low vehicle ownership, but for many this is by choice because of the transit access and connectivity provided by the Metrorail and extensive bus systems. While fast and reliable transit service is provided by the Metrorail into the District of Columbia and other activity centers along these radial routes, the transit service along the Purple Line corridor is hampered by slow and unreliable operations because it operates over a congested and indirect roadway network and often requires transferring between multiple routes and transit operators.

By 2030 and beyond, under the No Build conditions, the roadway congestion will increase due to increases in population and employment, resulting in vehicular trip growth. This will worsen transit travel times and reliability in the corridor. While Metrorail does provide some transit options for these trips, it requires taking circuitous routings into downtown Washington DC and back out again. Several communities in the corridor, especially the Takoma Park/Langley Park area, are in a wedge between the Metrorail lines and do not have even this option.

The TSM alternative would provide bus service that would operate as a single route for the entire corridor length and would not make as many local stops in order to improve travel times between the major activity centers. However, it would be hampered by the same roadway conditions as the current and future No Build bus services.

Because they would have similar alignments and stations, all the Build alternatives and the TSM alternative would serve essentially the same travel markets: providing access to the major activity centers along the corridor, and to the Metrorail at Bethesda, and Metrorail and MARC services at Silver Spring, College Park, and New Carrollton. The alternatives differ in the travel times and reliability they would provide. High Investment LRT would provide the fastest travel times along the corridor because of its higher investment in grade-separated segments that provide a travel time advantage over surface alignments, especially in East Silver Spring and the Riverdale Park area. By providing less grade separation and less exclusive surface-running operating environments, Low and Medium Investment LRT would offer slightly slower travel times than High Investment LRT. The LRT alternatives would offer faster end-to-end travel times than their BRT counterparts. West of Silver Spring, the BRT travel times are longer than their LRT counterparts because of routing differences. Westbound High Investment and Medium Investment BRT would follow a loop from the Georgetown Branch right-of-way under the buildings on either side of Wisconsin Avenue and on surface streets in downtown Bethesda, slowing the operating speeds. While this slower travel time would degrade the market attractiveness relative to the LRT alternatives for trips connecting to the Bethesda Metro Station, these two alternatives would actually provide better access to the downtown Bethesda employment market. Low Investment BRT and the Medium Investment BRT variation via Jones Bridge Road, because of their routing along Jones Bridge Road, would have the slowest travel time between Silver Spring and downtown Bethesda, although they would provide a direct

connection to the National Institutes of Health/ National Naval Medical Center area. These travel markets are already served by a number of transit services and would be comparably or even better served by the other Build alternatives using the Master Plan alignment.

As a result of having similar alignments, station locations, and service plans, the attractiveness of the Build alternatives to the transit markets and the resulting user benefits would primarily be a function of the travel time improvement differences among the alternatives. The LRT alternatives would attract more riders and new transit trips than the BRT and would generate more user benefits. The High Investment alternatives under LRT and BRT would produce higher number of riders, new trips, and user benefits than their respective Low and Medium Investment counterparts.

All alternatives have similar alignments and station locations. Therefore, the number of residents, employers, transit-dependent populations, and zero-car households served by the alternatives would be virtually the same and therefore are not a differentiating factor among the alternatives.

All alternatives have similar service plans and station locations. Therefore, transferring and interconnectivity to Metro, MARC, Amtrak, and bus services are not differentiating factors between the alternatives, except that the BRT alternatives would provide better connectivity with the existing bus facility at the Bethesda Metro Station.

High Investment LRT would be the most effective in addressing the mobility and accessibility objectives.

6.3.2. Improve Transit Operating Efficiencies

When transit vehicles have to operate within shared roadway environments, including crossing roadway intersections, the potential for delay increases. This in turn decreases the reliability of the service and lessens the operational efficiency. Because of the investment in tunnel segments, grade separation, and dedicated lanes, High Investment BRT and LRT would provide the most efficient and reliable operations. To a lesser degree, Low and Medium Investment BRT and LRT would provide these benefits. Dedicated lanes on the surface can provide many of the operational benefits of grade separation, at a lower cost.

Improved operating speeds enable more efficient operations because fewer vehicles and operators are required to provide the transit service. The BRT alternatives would have lower operating costs than the LRT alternatives. However, further refinement of the services' operating plans relative to the ridership demand level may lessen these differences. The incremental cost of adding more service is less for the LRT alternatives than for the BRT alternatives.

With the introduction of any one of the BRT or LRT alternatives as well as TSM, there would be opportunities to adjust the existing and future No Build bus network in the corridor to account for service redundancies, thereby reducing operating costs to the transit providers. However, these reductions would be similar across all alternatives.

6.3.3. Enhance Environmental Quality

All of the alternatives generally follow existing roadways and railroad rights-of-way. As a result, the environmental and community impacts are relatively minor in type and degree for projects of this nature. The roadways along which the alignment would run typically have heavy automobile, truck, and bus traffic operating along them.

High Investment BRT and all LRT alternatives would have some tunneled segments, which would in some instances run under residential and commercial properties. The effects on the surface structures and communities would be negligible. The tunnel portals and tunnel vent and emergency exit shafts would be the most noticeable features. This is especially true for tunnel portals located within residential areas such as in Silver Spring on Wayne Avenue and Arliss Street.

Because all the alternatives would have similar alignment characteristics, impacts on parks, wetlands, historic properties, business properties, and other environmentally sensitive sites would be similar between the alternatives, and are thus unlikely to be a differentiating factor among the alternatives.

In some specific instances, the impacts are seen by some in the local communities as onerous, specifically the change in the character of the Georgetown Branch right-of-way along which the Interim Georgetown Branch Trail is located. The re-introduction of rail operations with the Build alternatives, in conjunction with the construction of the permanent Capital Crescent Trail segment, as called for in the Montgomery County Master Plan for several decades, would remove essentially all the trees within the narrower portions of the right-of-way. While new landscaping would be added, it would be different in character than what exists today. The trees and vegetation on the properties abutting the right-of-way are expected to remain and would maintain much of the tree cover and visual character. The design features and character of the transitway and trail are intended to mitigate these concerns.

Some in the communities along certain street alignments, specifically Wayne Avenue, have concerns that BRT or LRT vehicles operating on the surface along this street would adversely affect the character of the street and adjoining neighborhoods. Others in the community view the introduction of these transit vehicles as compatible with the community character given that Wayne Avenue is already used by automobile, truck, and bus traffic.

6.3.4. Optimize Public Investment

Transportation system user benefits, community and economic benefits, and environmental benefits would be generated by all the Build alternatives to varying degrees depending on the specific attributes of the alternatives. These benefits would generally increase with increased levels of public capital investment. Ongoing public investment in operating and maintenance of the transit service would also be required. All the alternatives generate benefits and support a number of public objectives.

One measure that is useful for the comparative evaluation of the alternatives to show the degree of increased user benefits for increasing level of capital and operating costs is the FTA New Starts cost-effectiveness measure (see Section 6.4). Another measure is the annualized cost per new rider, which indicates the incremental benefit of each new rider attracted to transit. Based on these measures, the BRT alternatives would be more cost effective than the LRT alternatives, with Medium Investment BRT being the most cost effective. Medium Investment LRT is the most cost effective of the LRT alternatives. This demonstrates that the added investment in providing facilities that improve the operating speed and therefore the travel time for the Medium Investment alternatives generates more benefits relative to the costs than the Low Investment alternatives. However, the

incremental costs for providing additional improvements such as more grade-separated segments in the High Investment alternatives relative to the Medium Investment alternatives generate a diminishing rate of benefits.

While many of the mobility and cost-effectiveness measures are based on 2030 forecasts, consideration can be given to addressing the longer term transportation mobility capacity potential in the east-west corridor. The Purple Line corridor, especially for the Georgetown Branch right-of-way, purchased for use as a joint trail-transitway facility, would provide the only currently identified opportunity to increase east-west transportation mobility capacity inside the Capital Beltway (I-95/I-495) in Montgomery and Prince George's Counties. LRT technology has the potential to provide a higher passenger-carrying capacity in the corridor than BRT technology. Therefore, an LRT alternative that uses the Georgetown Branch right-of-way would provide the best opportunity to maximize the capacity for carrying passengers.

6.3.5. Support Local Plans for Economic and Community Development

Several areas in the corridor have been identified by local planning agencies as the focus of economic development. Improved transit service has been identified as an objective that would support this development. These areas include Flower Avenue/Long Branch, Takoma Park/Langley Park, College Park/Riverdale Park, and New Carrollton Metro Station.

All the alternatives, except No Build, would generally support the established county master plans and the state Smart Growth policies. Only the LRT alternatives support the Montgomery County Master Plan, which calls for LRT with the permanent Capital Crescent Trail along the Georgetown Branch right-of-way and along the CSX corridor to Silver Spring. All Build alternatives would support the Montgomery County Master Plan by constructing the permanent Capital Crescent Trail, although Low Investment BRT would not build the permanent trail west of Jones Mill Road (approximately two miles). The Prince George's County Master Plan supports the Purple Line in general, but does not identify a specific alignment. Both Montgomery and Prince George's Counties are in the process of developing functional master plans for the 16-mile Purple Line between Bethesda and New Carrollton.

All alternatives have nearly identical alignments and station locations and similar level of service and all would support the established economic and community development plans of the counties and local jurisdictions along the corridor. Therefore, these development measures are not a differentiating factor among the alternatives.

6.3.6. Contribute to Attainment of Regional Air Quality Goals

The TSM and all the BRT and LRT alternatives would attract automobile trips to transit thereby reducing automobile-generated mobile-source air pollutant emissions. Transit service is more fuel efficient and less polluting than automobile travel. High Investment LRT would attract the most automobile trips to transit. The LRT alternatives attract more automobile trips to transit than the BRT alternatives.

6.4. Cost Effectiveness

The cost-effectiveness analysis is a mechanism for comparing the total costs of a project to its benefits. A key measure used to determine the relative advantages of proposed transit systems is known as the cost-effectiveness index. This index is used to measure the benefits that users experience as a result of a new transit improvement, such as a LRT or BRT, compared with a TSM Alternative.

The cost-effectiveness index is determined by a formula described in *Technical Guidance on Section 5309 New Starts Criteria* (September 1997, with subsequent amendments) published by the FTA. The User Benefit measure is based upon basic economic theory; it measures the change in consumer surplus attributable to a new transportation investment. It is derived as the result of an arithmetic calculation of the total annual net cost of an alternative, divided by its benefits. The cost-effectiveness measure is calculated as:

$$\frac{\text{Change in (Annual Operating Cost + Annualized Capital Cost) from TSM}}{\text{User Benefits over the TSM Condition}}$$

The cost terms in the numerator are calculated as the difference in costs between the Build alternatives and the TSM Alternative. Thus, only the costs associated with the alternative are included. Both annual operating costs and the annualized capital costs are considered, regardless of the funding source.

The denominator term "user benefits over the baseline (TSM) condition" is a measure of change in total cost of travel from the TSM Alternative (including both time and monetary costs) expressed in terms of minutes. It is calculated within the region's mode choice model for all alternatives, including the baseline (No Build or TSM Alternative), and uses a measure of the traveler's value of time to convert monetary and other costs to their equivalence in time, which is added to actual time savings. In this way, the measure includes a more comprehensive accounting of the total costs of travel. The measure reflects the benefits for all travelers, not just transit users. It is frequently referred to as "Transportation System User Benefits" or "User Benefits."

The general methodology of this cost-effectiveness analysis translates the capital costs of the alternatives into equivalent uniform annual costs. These uniform annual capital costs reflect assumptions about the economic life of the capital components in each alternative (based on federal guidelines) and the cost of capital (i.e., the discount rate). Uniform annual capital costs are combined with annual operating and maintenance (O&M) expenses and then compared to the benefits of the alternatives to arrive at a cost-effectiveness index for the alternatives.

Placing the capital costs of the alternatives into a common framework involves calculating a stream of annual costs that is equivalent to their initial investment. These annual costs are referred to as an equivalent annual cost (EAC). The method of computing the EAC is straightforward: an annualization formula, which takes into account the discount rate and the useful economic life of major cost components, is applied directly to the initial year capital cost of each major component. For cost components with relatively long useful lives (over 25 years), this formula is approximately equal to the discount rate. In effect, the EAC represents the amount that would have to be invested each year to maintain the capital stock of the alternative at its initial level. The reason for converting the capital costs of each alternative to equivalent annual costs is that EAC can be compared with annual operating statistics and annual passengers, allowing for a reasonably uniform analysis of cost-effectiveness.

Because all costs used in the analysis are in constant dollars, the effects of inflation are already taken into account; the discount rate used in the analysis is a "real" discount rate that reflects prevailing interest rates net of the effect of inflation.

As noted above, key assumptions required for the derivation of equivalent annual cost include the choice of discount rates and the effective useful lives of all major cost components. These follow standard FTA Guidance for New Starts Projects, which provides information on depreciation rates for various cost elements, discount rates, and other direction on developing the user benefit numerator. Further information on the cost estimates is provided in Chapter 5, the *Capital Cost Estimating Methodology Technical Report*, and the *Operating and Maintenance Cost Estimate Technical Report*.

Table 6-3 presents the cost-effectiveness index for the alternatives with the mode-specific attributes user benefit included. As discussed in Chapter 3, user benefits can accrue to users of fixed guideway transit services due to attributes of these systems not reflected strictly in terms of travel times and out-of-pocket costs. These are referred to as "non-included attributes" or "mode-specific attributes" and account for perceived benefits that users feel they receive for amenities, comfort, reliability, safety and other characteristics of the mode. The degree to which these additional benefits accrue to the users depends on the definitions of the alternatives, including the guideway characteristics of the transit modal technologies. These would accrue to all the BRT and LRT alternative users to varying degrees depending on the specific attributes of the alternative. The inclusion of these mode-specific attributes, as are all the input values to the cost-effectiveness measure for New Starts purposes, is subject to discussions with FTA. However, the measure is very useful in the AA/DEIS for the comparative evaluation of the alternatives to show the degree of increased user benefits for increasing levels of capital and operating costs. The lower the number, the more cost-effective the alternative, under this particular method. It is also useful for assessing potential eligibility for New Starts funding.

Table 6-3: FTA Cost-Effectiveness Measures

	Total Capital Costs (2007 dollars)	Annualized Capital Costs (2007 dollars)	Annual O&M Costs (2007 dollars)	Annual User Benefit (Hours)	Annualized Cost per Hour of User Benefit
TSM	81,960,000	7,052,000	14,600,000	1,965,880	--
Low Investment BRT	386,390,000	31,266,000	17,300,000	3,441,270	$18.24
Medium Investment BRT	579,820,000	46,980,000	17,300,000	5,008,780	$14.01
High Investment BRT	1,088,480,000	87,040,000	15,800,000	6,164,200	$19.34
Low Investment LRT	1,206,150,000	96,480,000	26,400,000	5,784,940	$26.51
Medium Investment LRT	1,220,150,000	97,600,000	25,000,000	6,388,620	$22.82
High Investment LRT	1,634,840,000	125,895,000	22,800,000	7,299,040	$23.71

The results in Table 6-3 indicate that the BRT alternatives are more cost-effective than the LRT alternatives, with Medium Investment BRT being the most cost effective under this measure. Medium Investment LRT is the most cost effective of the LRT alternatives. This demonstrates that the added investment in providing facilities that improve the operating speed and therefore the travel time for the Medium Investment alternatives generates more benefits relative to the costs. However, the incremental costs for providing additional improvements in the High Investment alternatives relative to the Medium Investment alternatives generate a diminishing rate of benefits.

Medium Investment BRT Variations Serving Medical Center

In Section 2.4.5 two variations of Medium Investment BRT providing direct service to the Medical Center area were described: one where the alignment west of Jones Mill Road, instead of following the County–owned Georgetown Branch right-of-way that goes directly to Bethesda, would follow Jones Bridge Road to the Medical Center area and then follows Woodmont Avenue to the north entrance of the Bethesda Metro Station (as is the case for this section of Low Investment BRT), with an additional stop at St. Elmo Street along Woodmont Avenue; and the second, would extend the service of Medium Investment BRT from the north entrance of the Bethesda Metro Station, up Woodmont Avenue to the Medical Center Metro Station, directly across from the entrance to the NNMC, with a station at St. Elmo Street along Woodmont Avenue.

Table 6-4 provides a summary of the key effectiveness measures for the two variations relative to the Medium Investment BRT alternative. The Jones Bridge Road variation includes the $60 million capital cost of a new southern entrance at the Medical Center Metro Station.

The Jones Bridge Road variation shows that the longer routing to the larger Bethesda travel market results in a loss of 2000 daily boardings and 225,000 hours of annual user benefits relative to the Medium Investment BRT alternative. The FTA cost effectiveness index increases to $15.62 with the new station entrance, which is essential for the connection to the Metrorail Red Line at Medical Center under this variation. Without the entrance, the index goes to $14.04. The second variation, extending the Medium Investment BRT service to Medical Center from Bethesda increases the daily boardings by 6,000 and the annual users benefits by 236,000 hours. The cost effectiveness index for the second variation improves to $13.43. This indicates the benefits of serving the major Bethesda market directly while also providing a one-seat ride to the Medical Center area.

FTA annually defines ranges for rating projects submitted for consideration for New Starts funding. These ranges are updated occasionally to account for cost escalation and other such factors. Currently for FY09 New Starts Criteria submissions, a measure above $30.00 per hour is rated "Low," between $24.00 and $30.00 per hour is rated "Medium-Low," between $23.99 and $15.50 per hour is rated "Medium," between $15.49 and $12.00 is rated "Medium-High," and under $12.00 per hour is rate "High." These will likely change slightly by the time that a Purple Line Locally Preferred Alternative would be submitted to FTA for rating. All the alternatives would fall into the "Medium" range except for Low Investment LRT, which would fall into the "Medium-Low" range. For New Starts purposes at this point, an alternative should have a "Medium-Low" rating and preferably a "Medium" rating.

6.5. Financial Feasibility

Considerations of financial feasibility are based on the magnitude of the overall cost of the proposed transit improvements compared to the capacity of various funding programs and financial sources available to fund it. The overall

costs include both initial capital costs and the on-going costs of operations and maintenance. The funding sources include fare revenue from additional riders, federal programs, such as the FTA's New Starts program, State of Maryland funding, county and other sources, including private funding.

The proposed alternatives differ significantly in both capital and operating cost, ranging from a relatively minimal cost for the TSM and Low Investment BRT to more than $1 billion in capital costs and substantial annual operating costs for Medium and High Investment LRT. However, for the purposes of the AA/DEIS evaluation, all of the alternatives are potentially feasible provided that they generate sufficient transportation benefits to meet the requirements of the relevant federal and state funding programs.

6.6. Equity

Equity considerations generally fall within three classes:

- The extent to which the transit investments improve transit service to various population segments, particularly those that tend to be transit-dependent
- The distribution of the cost of the alternatives across population segments through the funding mechanism used to cover the local contribution to construction and operation
- The incidence of any substantial environmental effects, particularly in neighborhoods immediately adjacent to proposed facilities

The mobility and accessibility, economic and community development, and environmental benefits of the Purple Line alternatives generally accrue to the residents of the corridor as well as to the Washington metropolitan area, while the relatively few adverse effects are borne primarily by those persons residing in the corridor. Established regional and federal funding mechanisms would be used for construction and operation of the selected alternative, and new funding sources would be used to prevent diversion of resources (funding, service, or infrastructure) from other parts of the region.

6.6.1. Service Equity

All of the proposed alternatives, whether TSM, BRT, or LRT, would improve both the travel time, and the reliability of the transit service in this diverse corridor. The alternatives would function as both a line haul service connecting the major activity centers and communities along the corridor, and as a "collector-distributor" for trips using the Washington metropolitan area's extensive regional transit system, including the Metrorail, MARC, and Metrobus services and the local transit services operating in the two counties; and as an intra-corridor service for trips generated within the corridor. All alternatives would provide improved access to the corridor's employment centers; educational facilities; health centers; and institutional, cultural, recreational, entertainment, open space, retail, and governmental resources. No one group would receive a disproportionate share of these benefits to the detriment of another group.

6.6.2. Financial Equity

The Purple Line is expected to be financed by a combination of federal, state, and local funds. The existing funding structures of the MDOT/MTA, Montgomery and Prince George's Counties, and WMATA would continue to fund those services and capital programs throughout the region. A combination of new federal, state, and local funding and potentially, new sources of local funds, including new taxes, could be employed. The use of established federal and regional sources means no one group in the corridor or the region would receive a disproportionate share of the financial burden of the capital and operating and maintenance costs relative to the benefits received. No financial equity considerations would be raised by the project, either in terms of the source of subsidy or the level of fare payments required of passengers.

Table 6-4: Boardings, Costs, and Benefits of Medium BRT Variations

Measure	TSM	Medium Investment BRT	Variation 1 Medium Inv. BRT via Jones Bridge Road	Variation 2 Medium Inv. BRT extended to Medical Center
2030 Daily Boardings	16,900	52,000	50,000	58,000
Change Relative to Med Inv. BRT	NA	NA	(- 2000)	+ 6,000
Change Relative to TSM	NA	+34,900	+33,100	+41,100
2030 Annual User Benefits (hours)	1,966,000	5,008,000	4,783,000	5,244,000
Change Relative to Med Inv. BRT	NA	NA	(- 225,000)	+ 236,000
Change Relative to TSM	NA	+3,042,000	+2,817,000	+3,278,000
Capital Costs (2007 dollars)	$82,000,000	$580,000,000	$597,000,000	$585,000,000
Change Relative to Med Inv. BRT	NA	NA	+ $17,000,000	+ $5,000,000
Change Relative to TSM	NA	+$498,000,000	+$515,000,000	+$503,000,000
Annual O&M Cost (2007 dollars in millions)	$14,600,000	$17,300,000	$17,300,000	$18,300,000
Change Relative to Med Inv. BRT	NA	NA	$0.0	+$1,000,000
Change Relative to TSM	NA	+$2,700,000	+$2,700,000	+$3,700,000
FTA Cost-Effectiveness Measure (cost per hour of User Benefit) relative to TSM	NA	$14.01	$15.62 $14.04 without new southern Medical Center entrance	$13.43

6.6.3. Environmental Equity

Expanded transit services, whether TSM, BRT, or LRT, would provide environmental benefits to the region. By increasing transit use and attracting trips from automobiles, the alternatives would reduce emissions and energy, although these reductions would be a relatively small proportion of the regional totals. BRT and LRT are expected to provide enhanced economic development and community revitalization benefits to residents of the region and the corridor compared to the TSM Alternative. While there would be some adverse proximity effects for those communities located adjacent to the Georgetown Branch right-of-way purchased over two decades ago, and designated in the Montgomery County Master Plan for a joint

transitway and trail project, and along some of the street-running surface alignments, these communities would have access to the improved transit services provided and would be among the beneficiaries of the mobility and accessibility improvements.

6.7. Trade Offs

An overall assessment of how well each of the alternatives under consideration would help attain local goals and objectives involves consideration of all areas and measures described above. Moreover, it is dependent upon the priorities and value judgments placed on the individual items. Thus, while this section of the AA/DEIS report provides the necessary quantitative and qualitative assessments needed as a basis for decision-making, the final evaluation of performance of alternatives with respect to the attainment of local goals and objectives requires a collective analysis of the trade-offs involved in comparing relative advantages and disadvantages of the alternatives in each of the subject areas analyzed.

Transportation services and facilities connect people with their jobs, education, recreation, and other personal needs. Transportation services and facilities are essential for developing and sustaining the economy; they shape and affect our communities and environment. Therefore investments in transportation, particularly public investment in higher performing transit improvements, are intended to achieve objectives well beyond just mobility. Economic development, community development, and environmental objectives and measures must be considered along with mobility objectives when evaluating the high capacity transit alternatives for the corridor.

The No Build alternative would leave unaddressed the mobility problems for the various travel patterns to, from, and among the major activity centers, the residential communities and the regional transit system network, especially the Metrorail system. It leaves unaddressed the economic and community development, environmental, and master plan goals established for communities and jurisdictions along the corridor.

The TSM would address these problems to a limited degree, leaving many of the needs and goals unaddressed or under-addressed.

All the BRT and LRT alternatives would address the mobility problems and needs, and the economic and community development, environmental, and master plan goals established for communities and jurisdictions along the corridor. These goals would be maximized by the higher investment in LRT alternatives, particularly High Investment LRT. The capital cost and annual operating subsidy required for this alternative is substantial and would require a large commitment of federal, state, and local financial resources. A substantial amount of the benefits could be achieved at a lower cost by Medium Investment LRT. The BRT alternatives would require lower capital and annual operating subsidy investments and commitment of financial resources, but would provide lower achievements of mobility and other objectives.

As noted earlier, this document presents a record of the planning for the Purple Line up to the current time; however, interaction with local communities, agencies, and other stakeholders continues and ongoing studies may refine aspects of the alternatives, including possible additional design options. Three segments of the corridor under active study are the University of Maryland, the area east of downtown Silver Spring, and the Medium BRT variations between Jones Mill Road and downtown Bethesda. Coordination with stakeholders will continue throughout the planning process and could modify aspects of the alternative considered during the selection of the Locally Preferred Alternative.

An issue generating a high degree of interest in the Chevy Chase and Columbia County Club area is the use of the Georgetown Branch right-of-way in which the Interim Georgetown Branch Trail is located. The re-introduction of rail operations with the LRT alternatives, or introduction of BRT, in conjunction with the construction of the permanent Capital Crescent Trail segment, as called for in the Montgomery County Master Plan for several decades, would remove essentially all the vegetation within the narrower portions of the right-of-way. The trees and vegetation on the properties abutting the right-of-way are expected to remain and maintain much of the tree cover and visual character. The design features and character of the transitway and trail is intended to mitigate the impacts. The No Build and TSM Alternatives would not use the Georgetown Branch right-of-way but as described above would not address the needs and objectives for the corridor. The only Build alternative that would avoid the use of this segment of the Georgetown Branch right-of-way west of Jones Mill Road, would be Low Investment BRT and the Medium Investment BRT variation via Jones Bridge Road. While shifting any concerns of operating the transit service over to other communities along Jones Mill Road, this alternative also would be the least effective Build alternative in addressing the corridor needs and objectives. As discussed elsewhere in the AA/DEIS, even though Low Investment BRT and Medium Investment BRT variation via Jones Bridge Road run adjacent to the National Naval Medical Center, which will be the site of growth in employment and activity from the BRAC program, all the alternatives provide comparable if not better transit access and service in combination with existing Metrorail and bus services.

Tunnel and other types of underground construction of transit alignments require a much higher expenditure of capital funds than surface or even aerial alignments. The Build alternatives would employ tunnel sections where they would be required for topographic conditions or would provide operating speed improvements over surface alignments. The trade off of the higher capital cost and increase in mobility benefits was discussed earlier. Tunnels or underground construction, suggested by some for the Georgetown Branch right-of-way as an impact avoidance measure, would provide no operating speed or mobility benefits, while substantially increasing the capital costs and would thereby considerably lessen the cost-effectiveness of the alternative in the FTA New Starts rating. Similar suggestions for longer tunnels to avoid or further minimize community concerns, specifically along Wayne Avenue, would have similar effects since the longer tunnel segment provides little improvements in the mobility benefits relative to the higher capital cost.

Notwithstanding the effectiveness and cost-effectiveness of the Build alternatives, the availability of federal, state, and local capital funds may limit what could ultimately be spent for the implementation of a project in the corridor. Considerations of other transit projects in the state, transportation projects, and funding priorities, and availability of federal funds may establish an upper limit on what could be invested in the corridor. The response could involve: selecting an alternative that falls within the funding availability; implementing only a portion of an alternative (minimum operable segment or MOS), either as the full extent of the project or as an initial phase of the project with other phases implemented later; or deferring the implementation of a project until funding for the Locally Preferred Alternative is available.

Glossary and Acronyms

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Glossary

Accessibility: 1) The ability of vehicles and facilities to accommodate the disabled and comply with the Americans with Disabilities Act (ADA). **2)** A measure of the ability or ease of all persons to travel among various origins and destinations.

Advisory Council on Historic Preservation (ACHP): An independent federal agency that provides a forum for influencing federal policy, programs, and activities as they affect historic and archaeological resources in communities and on public lands nationwide.

Alignment: The horizontal and vertical location of a roadway, railroad, transit route or other linear transportation facility.

Alternative Analysis (AA): An analysis of the engineering, environmental, and financial feasibility of alternatives for major transit projects; required before federal funds can be allocated to a project. The AA is usually combined with the Draft Environmental Impact Statement and evaluated with analysis or environmental resources and impacts.

Alternatives: The set of transportation improvements or projects that are compared in the EIS to determine their effectiveness in serving as potential solutions to a transportation problem. Along with the set of "Build" Alternatives, there is a "No- Build," which tests the effects of not building a project, and a "TSM/TDM baseline" alternative, which tests a series of smaller incremental steps toward accomplishing the purposes of the build alternatives. Alternatives may consist of different configurations, alignments, type of access control or transportation modes and strategies.

Anadromous: Pertaining to fish that spend a part of their life cycle in the sea and return to freshwater streams to spawn.

Anthropogenic: Induced or altered by human activity.

Aquifer: A water-bearing rock, rock formation, or group of rock formations.

Area of Potential Effect (APE): The geographic area within which a transportation project may cause changes in the character of, or use of, historic properties. The APE is influenced by the scale and nature of the project, and there may be different kinds of effects caused by the undertaking.

At-Grade: On the ground, at surface level.

At-Grade Crossing: Same as a "grade crossing." A rail crossing with roadways or streets on the same level as the tracks, resulting in a level intersection of both modes. See grade separation.

Baseline Alternative: An alternative in the AA/EIS process that seeks to attain as much as possible of the goals of the build alternatives through a series of smaller, less expensive measures. Under NEPA the baseline is called the Transportation System Management (TSM/TDM) alternative. The Federal News Starts process requires a robust alternative called the (New Starts) Baseline Alternative.

Below grade: Placed below the ground surface, as with a subway or tunnel.

BIBI: Benthic Index of Biotic Integrity. An index that compares the macroinvertebrate community within a given stream to reference macroinvertebrate communities in the least-impaired streams using a series of metrics.

Build Alternative: A project alternative that involves a major capital investment.

Bus: Rubber-tired vehicles operating on fixed routes and schedules on roadways. Buses are powered by diesel, gasoline, battery or alternative fuel engines contained within the vehicle.

Bus Priority System: A system of traffic controls in which buses are given special treatment over other forms of transportation (e.g., bus priority lanes or preemption of traffic signals).

Bus Rapid Transit (BRT): A rubber-tired rapid transit mode that is a permanently integrated system of facilities, services and amenities that collectively improve the travel time, reliability and identity of traditional bus transit. BRT routes may be in exclusive right of way, reserved lanes in streets, or lanes shared with other traffic. These systems often use intelligent transportation systems technology, priority for transit, rapid and convenient fare collection, and integration with land use policy in order to substantially upgrade bus system performance.

Busway: Exclusive roadway reserved for buses and emergency vehicles.

Capital Costs: The one-time expenses incurred to design and build a transit system.

Catadromous fish: Fish that live most of their lives in freshwater, but migrate to seawater to spawn. American eels are catadromous.

Catenary System: Electric power system using an overhead contact wire and its supporting cables and wires. The contact wire provides an electrical power source for vehicles via pantographs, the contact mechanism on the roof of the vehicles.

Clean Air Act (CAA): Federal legislation that sets air quality standards. Sometimes cited as CAAA, Clean Air Act and Amendments of 1990.

Conductivity: A measure of the ability of water to conduct an electric current. It is related to the type and concentrations of dissolved ions in the water.

Connectivity: Connecting various transportation modes and services to minimize wait times between transfers and reduce overall travel time.

Constrained Long Range Plan (CLRP): Responds to federal requirements that funding sources be identified for all strategies and projects included in long-range plans. Updated at least every three years, the CLRP includes only those projects and strategies that can be implemented over the planning period with funds that are reasonably expected to be available.

Consolidated Transportation Program (CTP). The Maryland CTP presents the detailed listings and descriptions of the capital projects that are proposed for construction, or for development and evaluation during the next six-year period.

Construction Impact: Temporary impact that would occur over a short period of time while a project is under construction.

Constructive Use Impact: An impact adversely impacting activities on or enjoyment of a property without directly acquiring the property or any portion of the property. A new noisy project adjacent to a previously quiet outdoor theater would be an example of a constructive use impact.

Corridor: A long, generally slender land area surrounding an existing or planned transportation facility. The general purpose of a corridor is to

define a study area for future transportation planning improvements.

Cost Effectiveness Index: A measure of the effectiveness of a transit project using measured cost per new rider. The Federal Transit Administration has replaced this measure with Transportation System User Benefit.

Cultural Resources: Archaeological and historic resources eligible for or listed on the National Register of Historic Places. Cultural resources include buildings, sites, districts, structures, or objects having historical, architectural, archaeological, cultural, or scientific importance.

Cumulative impact: Impact that "results from incremental consequences of an action when added to other past and reasonably foreseeable future actions." The cumulative effects of an action may be undetectable when viewed in the individual context of direct and indirect impacts but can add to other disturbances and eventually lead to a measurable environmental change.

Cut and Cover: A tunnel construction method that involves excavating a large trench, building a roof structure, and then covering it with earth.

de minimis: Of insufficient significance. A de minimis contribution means that the environmental conditions would essentially be the same whether or not the proposed project is implemented. Used to evaluate impacts to parks under a 4(f) evaluation.

Dedicated Lanes: Travel lanes in a roadway which are reserved for transit use, often by striping or signage. These lanes are not physically separated from regular traffic and can be crossed by other vehicles. Lanes can be dedicated during peak hours only.

Demand Forecasting: A technique of estimating the number and travel times of potential users of a system.

Design Speed: The speed used for design and relationship of the physical features of a highway or rail that influence vehicle operation. It is the maximum safe speed that can be maintained over a specified section of highway or rail when conditions are favorable (i.e. – clear, dry, daylight).

Design Year: The year for which the facility is designed. The transit facility should be able to handle the traffic forecasted for that year which is generally 20 to 25 years in the future.

Determination of Eligibility: The process of assembling documentation to render professional evaluation of the historical significance of a property. Departments of Transportation, in consultation with the State Historic Preservation Office, apply the National Register of Historic Places criteria when deciding matters of historical significance.

Dissolved oxygen (DO): The amount of free (not chemically combined) oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million, or percent of saturation.

Double track: Two sets of tracks side by side, most often used for travel in opposite directions.

Draft Environmental Impact Statement: see Environmental Impact Statement

Dwell Time: The time, in seconds, that a transit vehicle spends at each stop waiting for passengers to alight and board.

Easement: A temporary or permanent right to use the land of another for a specific purpose sometimes referred to as a "deed restriction". Easements may be purchased from the property owner or donated by the owner to an agency.

Effects: "Effects" and "impacts" are synonymous. Effects include ecological, aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial. Effects include: (1) direct effects that are caused by the action and occur at the same time and place, and (2) indirect effects that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Electrofishing: A method of collecting fish in which fish are momentarily stunned by an electrical current passing through the water, allowing for capture and examination.

Elevated Guideway: A guideway that is positioned above the normal activity level (e.g. elevated over a street) either on an embankment or on a bridge.

Eminent Domain: Authority of the Agency to acquire property at fair market value for public purposes (not to be confused with meaning public buildings and improvements only). Also know as condemnation.

Endangered: An organism of very limited numbers that may be subject to extinction and is protected by law under the Endangered Species Act.

Envelope: Definition of the vertical and horizontal space required for both the transit vehicle and/or the guideway. Also called operating envelope.

Environmental Impact Statement: A public document that a Federal agency prepares under NEPA to document the expected impacts of a development or action on the surrounding natural and human environment. The document must detail efforts to avoid, minimize or mitigate any adverse impacts.

Environmental Justice (EJ): Presidential Executive Order 12898 requires federal agencies to ensure that their actions (or actions they oversee) do not disproportionately discriminate against or impact minority populations and low income populations.

Ephemeral stream: Have flowing water only during and for a short duration after precipitation events in a typical year. Groundwater is not a source of water for the stream.

Epifaunal : "Epi" means surface, and "fauna" means animals. Thus, "epifaunal substrate" are structures in the stream (on the stream bed) that provide surfaces on which animals can live. In this case, the animals are aquatic invertebrates (such as aquatic insects) or benthic fish species. These insects live on or under cobbles, boulders, logs, and snags, and the many cracks and crevices found in these structures. In general, older decaying logs are better suited for insects to live on/in than newly fallen "green" logs and trees.

Exclusive Rights-of-Way: Roadways, guideways, or other right-of-way reserved at all times for transit use.

Express: Express transit service is characterized by making few or no intermediate stops, and traveling faster than regular or local service.

Fare Box Revenue: Value of cash, tickets, tokens and pass receipts given by passengers as payment for rides; excludes charter revenue.

Feasible: Feasible means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

Feeder Service: Local bus service that moves passengers to collection points for express bus or rail service.

FEMA: Federal Emergency Management Agency. FEMA has ten regional offices, and two area offices. Each region serves several states, and regional staff work directly with the states to help plan for disasters, develop mitigation programs, and meet needs when major disasters occur.

FIBI: Fish Index of Biotic Integrity. An index that compares the fish community within a given stream to reference fish communities in the least-impaired streams using a series of metrics.

Final Design: The final engineering phase of a project's design process. During final design, contract plans and specifications necessary for bidding are prepared. These contract documents provide all the necessary information needed by suppliers and contractors to construct the project.

Financially Constrained: A term used to describe the financial requirement that all projects must have an identified funding source.

Finding of No Significant Impact (FONSI): A document prepared by a federal agency showing why a proposed action would not have a significant impact on the environment and thus would not require preparation of an Environmental Impact Statement (EIS). A FONSI results from the preparation of an Environmental Assessment and completes the NEPA process.

FIRM: Flood Insurance Rate Maps. Maps produced by the Federal Emergency Management Agency (FEMA) to determine the locations of flood risks and hazards.

Fixed Guideway: For rail transit systems, fixed guideways are the rail tracks. For bus systems, fixed guideways are roadways that can only be used by the buses. Federal usage in funding legislation also includes exclusive right-of-way bus operations as "fixed guideway" transit.

Floodplain (100-year): the area adjacent to a stream that is on average inundated once a century.

Geographic information system (GIS): A computer system capable of storing and manipulating spatial data.

Grade: 1. Refers to a rise in elevation within a specified distance. For example, a 1 percent grade is a 1-foot or 0.305 meter rise in elevation in 100 feet or 30.5 meters of horizontal distance. 2. The rate of upward or downward slope of a roadway, expressed as a percent. 3. “At grade” refers to a transportation facility built at ground level. in a level intersection of both modes. See grade separation.

Grade Separated Crossings: Facilities such as overpasses, underpasses, skywalks or tunnels that allow pedestrians and/or motor vehicles to cross a street at different levels.

Grade Separation: Two transportation rights-of-way that are separated vertically and for which there is no shared common intersection. A transit right-of-way may be fully grade-separated or partially grade- separated.

Groundwater: Subsurface water and underground streams that can be collected with wells, or that flow naturally to the earth's surface through springs.

Groundwater recharge: Increases in groundwater storage by natural conditions or by human activity. See also artificial recharge.

Guideway: A fixed facility for the operation of transit vehicles

Hazardous Materials: Material, often waste, that poses a threat to human health and/or the environment.

Headway: The time interval between transit vehicles operating in the same direction along a fixed route.

Heavy Rail (metro, or subway): An electric railway with the capacity for a heavy volume of traffic. This mode is characterized by high speed and rapid acceleration passenger rail cars operating singularly or in multi-car trains on fixed rails, separate rights-of-way (either above or below ground) from which all other vehicle and pedestrian traffic are excluded, and high platform loading. Often uses a third rail for power.

Impacts: See Effects.

Independent Utility: A project is said to have independent utility if it will provide functional improvements that can stand alone and serve a major purpose, even if no other improvements are made in the region.

Indirect Effects: Impacts on the environment resulting from the primary impact of the proposed action but occurring later in time or farther removed in distance, although still reasonably foreseeable.

Intelligent Transportation Systems (ITS): Computer-based technology applications designed to increase capacity, move traffic and transit more safely and efficiently, and to supply information to travelers. Examples include global positioning systems for locating vehicles and traffic signal priority for giving preferential green time to transit vehicles at intersections.

Intermittent stream: Streams that have flowing water during certain times of the year. Groundwater driven; runoff from rainfall or snowmelt is a supplemental source of water.

Intermodal: The ability to connect, and the connections between different modes of transportation.

Joint Development: Ventures undertaken together by the public and private sectors for development of land around transit stations or stops. See also transit oriented development.

Jurisdictional Determination (JD): A written statement issued by the U.S. Army Corps of Engineers that identifies areas within a discrete project area that are subject to Clean Water Act regulation. Usually refers to the regulating of a wetland or stream and its boundaries.

Kiss-and-Ride: A drive-through area, sometimes with short-term parking, to allow passengers to be dropped off or picked up at a transit station, with or without a kiss.

Level of Service (LOS): A qualitative measure describing operational conditions within a traffic stream; generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. LOS A represents free flow and LOS F represents gridlock.

Light Rail (streetcar, trolley car, and tramway): An electric railway with a "light volume" traffic capacity compared to heavy rail. Light rail is characterized by passenger rail cars operating individually or in short, usually two-car, trains. Light rail vehicles are typically driven electrically with power being drawn from an overhead electric line via a trolley or a pantograph. They can run on either exclusive rights-of-way with or without grade crossings, or in mixed traffic lanes on city streets.

Limited English Proficient (LEP): The limited ability to read, write, speak or understand English.

Limits of Disturbance: The horizontal boundary where soil will be exposed during construction activities. The limits of disturbance includes but is not limited to the limits of excavation, borrow

areas, storage areas, staging areas, areas to be cleared and grubbed, and roadways.

Line Haul: The trunk portion of a transit trip, as distinguished from local distribution.

Locally Preferred Alternative (LPA): The project alternative chosen by a sponsoring agency as a result of the federal project development process. It defines the alternative that is deemed best suited to meet the region's transportation goals, is responsive to community concerns and input and has been examined and declared superior in relation to its social, economic and environmental impacts.

Logical Termini: Rational endpoints for consideration of transportation improvements and for review of environmental impacts.

Low Floor Vehicles: Transit vehicles with lower floors that have a step-less entry and so allow wheelchairs to roll directly into the vehicle. In addition to improving accessibility, low floors also allow fully-mobile passengers to board more quickly. Passenger compartment floors are generally no more than 14 inches above the rail or street surface through at least a major portion of the vehicle

Low-Income Population: A low-income-household is one where the median household income is below the Department of Health and Human Services poverty guidelines.

Low-Income Population: Any readily identifiable group of low-income persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed federal transportation program, policy, or activity.

Macroinvertebrate: Invertebrates visible to the naked eye, such as insect larvae and crayfish.

Maintenance and Storage Facility: A site with facilities and buildings for the storage, maintenance, and cleaning of transit vehicles and the storage of other system maintenance equipment. May also include crew facilities such as locker rooms and break facilities.

Minimum Operating (Or Operable) Segment: A smaller, cost-effective portion of the locally preferred alternative with independent utility (meaning it can function as a stand-alone project and not be dependent on the construction of any future segments).Often, the locally preferred alternative is too large or too costly to construct in a single phase. The minimum operable segment is the segment identified as first to construct.

Minimization: Measures taken to reduce adverse impacts on the environment.

Minority: A person who is: (1) Black (having origins in any of the black racial groups of Africa); (2) Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race); (3) Asian American (having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); or (4)American Indian and Alaskan Native (having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition).

Minority Population: Any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed federal transportation program, policy, or activity

Mitigation: Mitigation refers to measures undertaken when impacts remain after efforts to avoid or minimize the impacts.

Mixed Traffic: The operation of rail vehicles on public roads with car and truck traffic. Where rail tracks are embedded in the road, rail vehicles and cars can share the same road. Rail vehicles must obey all traffic laws, such as speed restrictions and stoplights, when operating in areas of mixed traffic.

Mixed Use Development: Development with multiple categories of land use typically including residential, commercial, retail, and entertainment. Mixed-use areas generally have higher population densities and are pedestrian friendly.

Modal Split: A term that describes how many people use alternative forms of transportation. Frequently used to describe the percentage of people using private automobiles as opposed to the percentage using public transportation.

Mode: Refers to a specific form of transportation (auto, bus, LRT, heavy rail, pedestrian, bicycle, etc.).

Model: An analytical tool (often mathematical) used by transportation planners to assist in making forecasts of land use, economic activity, travel activity and their effects on the quality of resources such as land, air and water.

Monorail: An electric railway in which a rail car or train of cars is suspended from or straddles a guideway formed by a single beam or rail.

Multimodal: Having or involving several modes of transportation.

National Environmental Policy Act (NEPA): The federal law that requires every federal agency to evaluate the effect of its proposed actions on the natural and man-made environment by doing an Environmental Assessment or Environmental Impact Statement.

National Register eligible: Cultural resources eligible for inclusion on the National Register of Historic Places. Eligible resources receive the same protection as registered resources.

National Register of Historic Places: A federal listing of historic resources protected under the National Historic Preservation Act of 1966. Properties include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture.

New Start: Discretionary federal funding program for the construction of new fixed guideway systems or extensions of existing fixed guideway systems, based on cost effectiveness, alternatives analysis results and the degree of local financial commitment.

No-Build Alternative: A reasonable alternative showing projected future conditions of an area in the absence of the proposed project, which serves as a benchmark to which the impacts of the build alternatives can be compared. As part of this alternative, short-term minor reconstruction, such as safety upgrading and maintenance projects, can be considered.

Off-Board Fare Collection: Collection of transit fares off the vehicle, typically at a station. Boarding time is greatly reduced with off-board fare collection. When off board fare collection is used, verification of fare payment is often made by random inspection onboard vehicles.

Off-Peak Period: Non-rush periods of the day when travel activity is lower, also called "base period."

Operating And Maintenance Costs (O&M Costs): All cost involved with running a transit system, including labor for operations and for vehicle and fixed facility maintenance, fuel

and/or electric power, spare parts and other supplies, insurance premiums and claims payments, direct supervision, and general and administrative expenses.

Operating Plan: For transit, an operating plan detailing characteristics such as running times, frequency, required number of vehicles, changes in frequency throughout the day, and assumptions pertaining to stations.

Origin-Destination Study: A method to determine where trips are coming from and going to, or where they desire to travel.

Park-and-Ride Lot: A parking lot to which passengers drive their cars, leave them for the day, and either board transit vehicles or carpool.

Peak (Peak Period, Rush Hours): The period during which the maximum amount of travel occurs. It may be specified as the morning (a.m.) or afternoon or evening (p.m.) peak.

Performance Measures: Indicators of how well the transportation system is performing with regard to such things as average speed, reliability of travel, and accident rates. Used as feedback in the decision-making process.

Perennial streams: Streams that flow year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow.

Preliminary Engineering: At the preliminary engineering phase the design is approximately 30 percent complete. The deliverables at the 30 percent submittal includes contract drawings, specifications, design calculations and a preliminary cost estimate. Environmental impacts and property impacts/requirements will be noted on the plans.

Public Hearing: A formal meeting called to receive public comment on proposed action.

Public Meeting: An informal meeting called to present information about and to discuss proposed action.

Queue: A line of vehicles stopped at an intersection, merge or diverge point.

Queue Jump Lane: A short, exclusive lane that allows buses to move to the head of a line of traffic.

pH: (Power of Hydrogen); The negative logarithm of the molar concentration of the hydrogen ion, or, more simply acidity.

Portal: The structure through which a highway or railroad enters or exits an underground tunnel to or from the surface.

Purpose and Need Statement: A project purpose is a broad statement of the overall objective to be achieved by a proposed action. Need is a more detailed explanation of the specific transportation problems that exist or are expected to occur in the future. It is the foundation to determine if alternatives meet the needs in the area.

Record of Decision (ROD): The final approval of an Environmental Impact Statement which will be issued by Federal Transit Administration. It is a public document that explains the reasons for a project decision and summarizes any mitigation measures that will be incorporated in the project. Obtaining the ROD is the last step in the NEPA process. After a ROD is received, permits and right-of-way can be acquired.

Ridership: The number of rides taken by people using a public transportation system in a given time period.

Riprap: Rock or other material with a specific mixture of sizes referred to as a "gradation," used to stabilize streambanks or riverbanks from erosion or to create habitat features in a stream.

(Public) Right-of-Way (ROW or R/W): The area over which a legal right of passage exists; land used for public purposes in association with the construction or provision of public facilities, transportation projects, or other infrastructure.

Scoping: This is the first step in the NEPA process and determines the range of proposed actions, alternatives, and impacts to be discussed in a DEIS. The required scoping process provides agencies and the public opportunity to comment. Scoping is used to encourage cooperation and early resolutions of potential conflicts, to improve decisions, and to reduce paperwork and delay.

Secondary and Cumulative Effects Analysis (SCEA): Secondary or indirect impacts are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." Cumulative effects are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (Federal, or non-Federal) or person undertakes such other actions." Potential secondary and cumulative effects on the environment must be assessed as required by the National Environmental Policy Act (NEPA).

Secondary Effects: Secondary (or indirect) effects are those that are caused by an action and are later in time or farther removed in distance but are still reasonably foreseeable. Secondary effects can include changes in land use, water quality, economic vitality or population density. An example of a secondary effect of a transit project would be new housing or commercial development near station areas – development that is not constructed as part of the project itself, but that occurs as a result of the project.

Section 106: The section of the National Historic Preservation Act that requires federal agencies to consider the potential effects of proposed federal action on any known or potential historic, architectural, or archaeological resources.

Section 4(f): Section 4(f) of the US Department of Transportation Act of 1966, which includes a national policy to make special effort to preserve the natural beauty of the countryside, public parks and recreation lands, wildlife and waterfowl refuges, and significant historic sites. Use of these lands for a transportation project will be permitted only when it has been determined that there is no feasible and prudent alternative and the project includes all possible planning to minimize harm to the property resulting from such use.

Shared Lanes: Surface streets in which transit operates in lanes with regular traffic.

Signal prioritization: Technique of altering the sequence or timing of traffic signals at intersections to provide priority treatment for transit vehicles.

Spawning: The depositing and fertilizing of eggs (or roe) by fish and other aquatic life.

Stakeholders: Individuals and organizations involved in or affected by the transportation planning process. Include federal/state/local officials, MPOs, transit operators, freight companies, shippers, and the general public.

State Transportation Improvement Program (STIP): The STIP is the accumulation of transportation improvement programs of the state's (6) MPOs and the projects programmed in the non-MPO areas of the state. In Maryland, it is primarily the Program of Projects included in the State's Six Year Consolidated Transportation Program. The first two years of the program are projects incorporated into the state's annual budget. The remaining four years are projects programmed with level of certainty that funding will be approved in subsequent state budget bills. The STIP is financially constrained and the

projection of revenues in future years are analyzed and approved by the state's (non-partisan) revenue forecasting committee.

Stormwater Management (SWM): Physical design features such as ponds, bioretention, or drainage swales that retain or direct stormwater run-off in a manner that controls discharge volumes and/or water quality.

Streetscape: The space between the buildings on either side of a street that defines its character. The elements of a streetscape can be natural or man-made and include buildings, set back of buildings, sidewalks, signs, public furnishings, trees, landscaping, street lights, above-ground utilities, bus stop shelters and street furniture.

Terminal Station: The last bus or rail station where a route or line terminates.

Traction Power Substation (TPSS): Substations converting alternating current from the power grid to the voltage and type of current needed for the LRT or streetcar vehicle.

Traffic Analysis Zone (TAZ): A geographic area typically ranging in size from a city block to a one-square-mile section (or larger) used in computer models that project changes in traffic flow based on estimated land use changes, population growth, employment growth, and other factors.

Transfer: The portion of a trip between two connecting transit routes, both of which are used for completion of the trip.

Transit Center: A primary station in a multi-destination transit system where passengers may conveniently transfer among trunk lines, local feeder routes, and/or modes. Also referred to as intermodal transfer facilities, transportation centers, stations, and terminals.

Transit Dependent Population: Generally those without their own means of transportation (e.g., zero-car households, children, low-income groups, some elderly, and those who are unable to operate a vehicle due to a physical disability).

Transit Oriented Development (TOD): A term used for urban development that encompasses a direct and planned access to transit facilities.

Transportation Demand Management (TDM): A program that improves transportation system efficiency by altering transportation system demand using such strategies and facilities as: pricing, ridesharing; park-and-ride facilities, transit friendly development / zoning; and employer-based programs—such as staggered work hours and telecommuting. TDM programs improve the efficiency of existing facilities by changing demand patterns rather than embarking on capital improvements.

Transportation System Management (TSM): That part of the urban transportation process undertaken to improve the efficiency of the existing transportation system. The intent is to make better use of the existing transportation system by using short term, low capital transportation improvements that generally cost less and can be implemented more quickly than system development actions. TSM strategies consider such options as improvements to public transit systems, minor intersection improvements, signal timing improvements, and traffic management.

Transportation System User Benefit: A measurement of the project benefit. The measurement divides the cost (including capital, and operations and maintenance) by the travel time savings of all users of the transit system (including existing and new riders). This measure is part of the FTA New Starts evaluations.

Travel Demand Forecast: A forecast for travel demand on future or modified transportation system alternatives using existing or projected land use, socioeconomic, and transportation services data.

Travel Time: The average time required to travel between two points, including delays at intersection, but not including terminal or waiting time.

Tunnel: an underground alignment which can be constructed using either cut and cover or deep boring methods.

Turbidity: An optical measure of the clarity of water by light scattering from suspended and dissolved constituents in the water column.

Viewshed: A viewshed is an area visible from a fixed vantage point. A viewshed can be an area of particular scenic or historic value deemed worthy of preservation. A viewshed can be an area viewed from a transportation facility or can be an area viewed from the area near or looking at the transportation facility including the facility.

Wetlands: As defined by the U.S. Army Corps of Engineers, wetlands are areas that are inundated or saturated by surface water or groundwater sufficiently to support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and similar areas and are subject to protection under Executive Order 11990 and Section 404 of the Clean Water Act.

Yard and Shop: See Maintenance and Storage Facilities.

Acronyms

AA	Alternatives Analysis
AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ADT	Average Daily Traffic
APE	Area of Potential Effect
BIBI	Benthic Index of Biotic Integrity
BMPs	Best Management Practices
BRAC	Base Realignment and Closure
BRT	Bus Rapid Transit
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CAA	Federal Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLRP	Constrained Long Range Plan
CTP	Consolidated Transportation Plan
CWA	Clean Water Act
CWP	Center for Watershed Protection
CZMA	Coastal Zone Management Act
DBP	Disinfection By-Product
DEIS	Draft Environmental Impact Statement
DNR	Maryland Department of Natural Resources
DO	Dissolved Oxygen
EIS	Environmental Impact Statement
EJ	Environmental Justice

EPA	United States Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, Trichoptera
ESA	Endangered Species Act
FCA	Maryland Forest Conservation Act
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIBI	Fish Index of Biotic Integrity
FIDS	Forest Interior Dwelling Species
FIRM	Flood Insurance Rate Maps
FONSI	Finding of No Significant Impact
FTA	Federal Transit Administration
GIS	Geographic Information System
GPS	Global Positioning System
ITS	Intelligent Transportation Systems
HOV	High Occupancy Vehicle Lanes
JD	Jurisdictional Determination
L_{10}	Noise level equaled or exceeded 10 percent of the time
L_{eq}	Equivalent Sound Level
LEP	Limited English Proficient
LOS	Level of Service
LPA	Locally Preferred Alternative
LRT	Light Rail Transit
LRV	Light Rail Vehicle
MBSS	Maryland Biological Stream Survey
MCDEP	Montgomery County Department of Environmental Protection
MCL	Maximum Contaminant Load
MDE	Maryland Department of the Environment
MGS	Maryland Geological Survey
MHT	Maryland Historical Trust
M-NCPPC	Maryland-National Capital Park and Planning Commission
MOA	Memorandum of Agreement
MOS	Minimum operable segment
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MTA	Maryland Transit Administration
MTBE	Methyl Tertiary Butyl Ether
MWCOG	Metropolitan Washington Council of Governments
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTD	National Transit Data
NTU	Nephelometric Turbidity Units
NWI	National Wetlands Inventory
O&M	Operations and Maintenance
PCBs	Polychlorinated Biphenyls
PGDER	Prince George's County Department of Environmental Resources
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
PM2.5	Particulate Matter with an Aerodynamic Diameter less than 2.5 Micrometers
PM10	Particulate Matter with an Aerodynamic Diameter less than Ten Micrometers
POW	Palustrine Open Water Wetland
PSS	Palustrine Scrub-Shrub Wetland
QA/QC	Quality Assurance/Quality Control
ROD	Record of Decision
ROW	Right-of-Way
RTE	Rare, Threatened, and Endangered
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SAV	Submerged Aquatic Vegetation
SCC	FTA's Standard Cost Categories
SCEA	Secondary and Cumulative Effects Analysis
SHPO	State Historic Preservation Officer
SPA	Special Protection Area
STIP	State Transportation Improvement Program
SWM	Stormwater Management
TAZ	Traffic Analysis Zone
TDS	Total Dissolved Solids
TIP	Transportation Improvement Program
TMD	Transportation Demand Management
TMDL	Total Maximum Daily Load
TOD	Transit Oriented Development
TPSS	Traction Power Substation
TSM	Transportation System Management
TTF	Maryland Transportation Trust Fund
UM	University of Maryland
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USDOI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	Underground Storage Tank
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
WHD	DNR Wildlife and Heritage Division
WMATA	Washington Metropolitan Area Transit Authority
WSSC	Washington Suburban Sanitary Commission
YOY	Young of the Year

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Bladensburg Library
Chevy Chase Library
Greenbelt Library
Hyattsville Library
Long Branch Library
Maryland Department of Legislative Services Library
Maryland State Archives
Maryland State Law Library
New Carrollton Library
Silver Spring Library
State Library Resource Center
Takoma Park Maryland Library
University of Maryland Library

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Maryland Transit Administration
Montgomery County MNCPPC
Prince George's County MNCPPC
Silver Spring Regional Services Center
Maryland Department of Transportation
Regional Office

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(Executive Summary)

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Senator Benjamin L. Cardin

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District 2
Representative C. A. Dutch Ruppersberger, III
District 3
Representative John P. Sarbanes
District 5
Representative Steny H. Hoyer
District 6
Representative Roscoe G. Bartlett
District 7
Representative Elijah E. Cummings
District 8
Representative Christopher Van Hollen, Jr.

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(Executive Summary)

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District 18
Senator Richard S. Madaleno, Jr.
District 20
Senator Jamin B. Raskin
District 21
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District 22
Senator Paul Pinsky
District 47
Senator David C. Harrington

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Delegate Susan C. Lee
District 18
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Delegate Alfred C. Carr, Jr.
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District 20
Delegate Sheila E. Hixson
Delegate Thomas Hucker
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District 22
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Delegate Anne Healey
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District 47
Delegate Jolene Ivey
Delegate Doyle L. Niemann
Delegate Victor R. Ramirez

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(Executive Summary)

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County Executive
Isiah Leggett

Prince George's County
County Executive
Jack B. Johnson

Montgomery County Council
District 1
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District 2
Councilmember Mike Knapp
District 3
Councilmember Phil Andrews
District 4
Councilmember Donald Praisner
District 5
Councilmember Valerie Ervin
At-Large
Councilmember Marc Elrich
At-Large
Councilmember Nancy Floreen
At-Large
Councilmember George Leventhal
At-Large
Councilmember Duchy Trachtenberg

Prince George's County Council
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District 2
Councilmember William A. (Will) Campos
District 3
Councilmember Eric C. Olson
District 4
Councilmember Ingrid M. Turner
District 5
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